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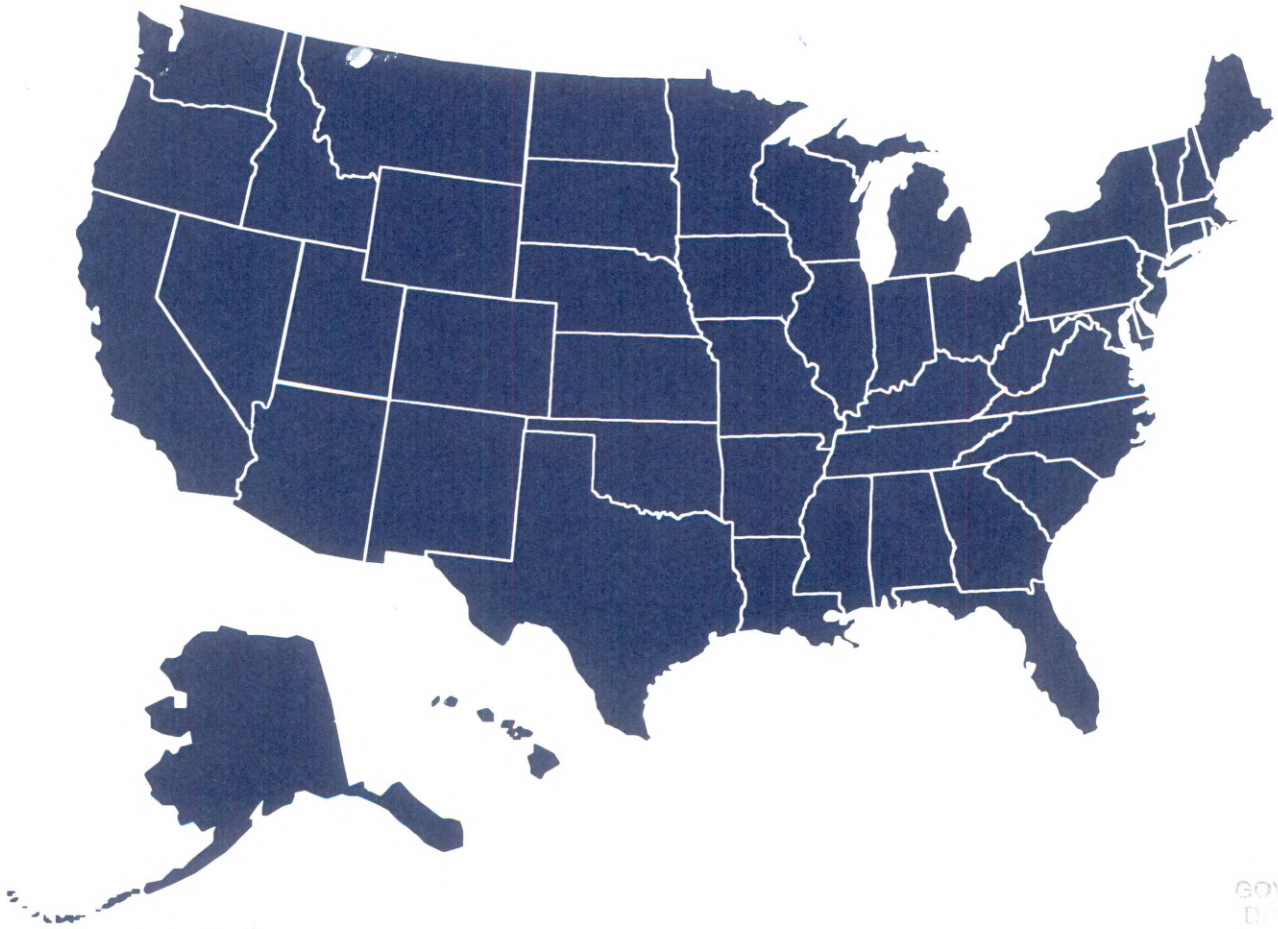
MINERALS YEARBOOK

Area Reports: Domestic 1997

Volume II



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U.S. Department of the Interior
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MINERALS YEARBOOK

Area Reports: Domestic 1997

Volume II

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U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
CHARLES GROAT, Director

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1999

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Foreword

This edition of the U.S. Geological Survey (USGS) Minerals Yearbook discusses the performance of the worldwide minerals and materials industry during 1997, and provides background information to assist in interpreting that performance. Content of the individual Minerals Yearbook volumes follows:

- Volume I, Metals and Minerals, contains chapters about virtually all metallic and industrial mineral commodities important to the U.S. economy. Chapters on survey methods, summary statistics for domestic nonfuel minerals, and trends in mining and quarrying in the metals and industrial mineral industries in the United States are also included.
- Volume II, Area Reports: Domestic, contains a chapter on the mineral industry of each of the 50 States and Puerto Rico and the Administered Islands. This volume also has chapters on survey methods and summary statistics of domestic nonfuel minerals.
- Volume III, Area Reports: International, is published as four separate reports. These regional reports contain the latest available minerals data on more than 190 foreign countries and discuss the importance of minerals to the economies of these nations and the United States. Each report begins with an overview of the region's mineral industries during the year. It continues with individual country chapters that examine the mining, refining, processing, and use of minerals in each country of the region and how each country's mineral industry relates to U.S. industry. Most chapters include production tables and industry structure tables, information about Government policies and programs that affect the country's mineral industry, and an outlook section.

The USGS continually strives to improve the value of its publications to users. Constructive comments and suggestions by readers of the Minerals Yearbook are welcomed.

Charles G. Groat
Director

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Contacts

Information about the U.S. Geological Survey, its programs, staff, and products may be accessed on the World Wide Web at URL http://www.usgs.gov/. Aerial photography, digital data, geologic, and map products and information are available by contacting the Earth Science Information Center at 1-888-ASK-USGS. Water Data and Information may be obtained by contacting the Water Information Center at 1-800-426-9000. For specific information about this publication, contact the Chief, Publication Services Section, Minerals Information Team at (703) 648-4750. Information about the Minerals Information Team may be accessed on the World Wide Web at URL http://minerals.er.usgs.gov/minerals/.

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Acknowledgments

The volume was produced by Arnold Tanner and Roger Loebenstein, both physical scientists with the Minerals Information Team of the U.S. Geological Survey (USGS). All commodity rankings and statistical analyses were performed by Mr. Tanner and were based on data reported to the USGS by companies responding to the annual canvasses of nonfuel mineral producers in the United States. Mineral production data and related rankings for 1997 are preliminary owing to publication of this volume before final data for all commodities were available. Data and related rankings prior to 1997 are from final tabulations. For crushed stone and construction sand and gravel, each State chapter includes tabular data by State districts, where applicable, based on final 1996 data. Compilations of data contained in this volume were largely based on statistics and other data provided by the mineral industries. The USGS gratefully acknowledges the willing contribution of these essential data by both companies and individuals. Information regarding a State's mining industry, mineral exploration, and other mining-related activities or legislation was derived from information submitted by officials from each participating State. We thank those State agencies that contributed mining and minerals industry information for their States. Their submissions significantly broadened the scope of those chapters and their participation in this joint project is greatly appreciated. Authors of text submissions from participating States are referenced by footnote in each chapter as appropriate. All chapters underwent technical review by USGS mineral commodity specialists and other agency professionals. The melding of their knowledge and expertise into this project was invaluable in producing accurate individual documents and is greatly appreciated. Previously, all State chapters were published individually under the title "Mineral Industry Surveys." Maps indicating "principal mineral-producing locations" lead off each respective chapter. The State maps were fully updated and revised in November 1995 in collaboration with the State Geologists and/or minerals information agency Directors of each State. A small number of State maps received further updates in 1996 and in 1997.

In the collection of statistical and other mineral industry information, the USGS also was assisted by various State agencies through cooperative memoranda of understanding (MOU's). Some of the chapters in this publication were reviewed by staff members of these State agencies. Our sincere appreciation for all agency cooperation is extended to the State government agencies which have MOU's with the USGS. These are as follows:

Alabama: Geological Survey of Alabama.
Arizona: Arizona Department of Mines and Mineral Resources.
Arkansas: Arkansas Geological Commission.
California: California Department of Conservation, Division of Mines and Geology.
Colorado: Colorado Geological Survey.
Connecticut: Connecticut Geological and Natural History Survey.
Delaware: Delaware Geological Survey.
Florida: Florida Geological Survey.
Georgia: Georgia Geologic Survey.
Idaho: Idaho Geological Survey.
Illinois: Illinois State Geological Survey.
Indiana: Indiana Geological Survey.
Iowa: Iowa Geological Survey Bureau.
Kansas: Kansas Geological Survey.
Kentucky: Kentucky Geological Survey.
Louisiana: Louisiana Geological Survey.
Maine: Maine Geological Survey.
Maryland: Maryland Department of the Environment, Minerals, Oil and Gas Division.
Massachusetts: Massachusetts Executive Office of Environmental Affairs, Office of the State Geologist.
Michigan: Michigan Department of Environmental Quality, Geologic Survey Division.
Mississippi: Mississippi Department of Environmental Quality, Office of Geology.
Missouri: Missouri Department of Natural Resources, Division of Geology and Land Survey.
Montana: Montana Bureau of Mines and Geology.
Nebraska: University of Nebraska-Lincoln, Nebraska Geological Survey.
Nevada: Nevada Bureau of Mines and Geology.
New Hampshire: New Hampshire Department of Environmental Services.
New Jersey: New Jersey Geological Survey.
New Mexico: New Mexico Bureau of Mines and Mineral Resources.
New York: New York State Geological Survey.

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North Carolina: North Carolina Geological Survey.
North Dakota: North Dakota Geological Survey.
Ohio: Ohio Division of Geological Survey.
Oklahoma: Oklahoma Geological Survey.
Pennsylvania: Pennsylvania Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey.
Puerto Rico: Puerto Rico Department of Natural and Environmental Resources, Bureau of Geology.
Rhode Island: Rhode Island Department of Geology, Office of the State Geologist.
South Carolina: South Carolina Geological Survey.
South Dakota: South Dakota Geological Survey.
Tennessee: Tennessee Department of Environment and Conservation, Division of Geology.
Texas: The University of Texas at Austin, Texas Bureau of Economic Geology.
Utah: Utah Geological Survey.
Vermont: Vermont Geological Survey.
Virginia: Virginia Department of Mines, Minerals and Energy, Division of Mineral Resources.
Washington: Washington State Department of Natural Resources, Division of Geology and Earth Resources.
West Virginia: West Virginia Geological and Economic Survey.
Wisconsin: Wisconsin Geological and Natural History Survey.
Wyoming: Wyoming State Geological Survey.

John H. DeYoung, Jr.
Chief Scientist, Minerals Information Team

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SURVEY METHODS FOR NONFUEL MINERALS

By Kenneth W. Mlynarski

The U.S. Geological Survey (USGS) collects worldwide data on virtually every commercially important nonfuel mineral commodity. These data form the base for tracking and assessing the health of the minerals sector of the U.S. economy.

The USGS data collection activity was instituted by the 47th Congress in an appropriations act of August 7, 1882 (22 Stat. 329), which placed the collection of mineral statistics on an annual basis. The most recent authority for the USGS survey activity is the National Materials and Minerals Policy, Research and Development Act of 1980 (Public Law 96-479, 96th Congress). This act strengthens protection for proprietary data provided to the U.S. Department of the Interior by persons or firms engaged in any phase of mineral or mineral-material production or consumption.

Data Collection Surveys

The USGS begins the collection of domestic nonfuel minerals and materials statistics by appraising the information requirements of Government and private organizations of the United States. Requirements that can be met by collecting data from minerals establishments are posed as questions on USGS surveys. Figure 1 shows a typical survey form.

Specific questions about mineral commodity activities such as production, consumption, and shipments are structured in the survey forms to provide meaningful aggregated data. Thus, the entire mineral economic cycle from production through consumption is covered by 144 monthly, quarterly, semiannual, and annual surveys.

After the survey form has been designed, a list of the appropriate establishments to be canvassed is developed. Many sources are used to determine which companies, mines, plants, and other operations should be included on the survey mailing list. State geologists, Federal organizations (e.g., Mine Safety and Health Administration), trade associations, industry representatives, and trade publications and directories are some of the sources that are used to develop and update survey listings. With few exceptions, a complete canvass of the list of establishments is employed rather than a sample survey. The iron and steel scrap industry is one of the exceptions where a sample survey is conducted.

The Paperwork Reduction Act requires that any Government agency wanting to collect information from 10 or more individuals or establishments must first obtain approval from the Office of Management and Budget (OMB). OMB approves the need to collect the data and protects industry from unwarranted Government paperwork.

Survey Processing

The USGS surveys approximately 18,000 establishments. Each year, the USGS mails about 40,000 forms that gather information for 144 different surveys. Each completed survey form returned to the USGS undergoes extensive analysis to ensure the highest possible accuracy of the mineral data. The statistical staff monitors all surveys to ensure that errors are not created by reporting in physical units different from the units requested on the form. Relationships between related measures, such as produced crude ore and marketable crude ore, are analyzed for consistency. Engineering relationships, such as recovery factors from ores and concentrates, also are employed. The totals for each form are verified, and currently reported data are checked against prior reports to detect possible errors or omissions.

For the majority of the surveys, which are automated, the forms are reviewed to ensure that data are complete and correct before entering into the computer. The computer is programmed to conduct a series of automated checks to verify mathematical consistency and to identify discrepancies between the data reported and logically acceptable responses.

The USGS is modernizing and automating all of its survey processing and data dissemination functions. Automated commodity data system functions include computerized preparation of statistical tables, the use of desktop publishing to integrate text and tables, and electronic dissemination through the Internet. Also, information on minerals and mineral-related publications is now available through an easy-to-use automated fax response system known as MINES FaxBack.

Survey Responses.—To enable the reader to better understand the basis on which the statistics are calculated, each commodity annual report includes a section entitled "Domestic Data Coverage." This section briefly describes the data sources, the number of establishments surveyed, the response percentage, and the method of estimating the production or consumption for nonrespondents.

To produce reliable aggregated data, the USGS employs efficient procedures for handling instances of nonresponse. Failure to return the initial survey form results in a second mailing of the form. If the second form is not returned, telephone calls are made to the nonrespondents. The follow-up calls provide the necessary data to complete the survey forms and/or verify questionable data entries. Periodic visits to minerals establishments also are made by USGS mineral commodity specialists to gather missing data and to explain the importance of the establishment's reporting. By describing the use of the published statistics and showing the impact of nonresponse, the

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USGS strives to encourage respondents to give a complete and accurate reply.

The OMB "Guidelines for Reducing Reporting Burden" stipulates that the minimum acceptable response rate shall be 75% of the panel surveyed. In addition, the USGS strives for a minimum reporting level of 75% of the quantity produced or consumed (depending on the survey) for certain key statistics. Response rates are periodically reviewed. For those surveys not meeting the minimum reporting level, procedures are developed and implemented to improve response rates.

Estimation for Nonresponse.—When efforts to obtain a response to a survey fail, it becomes necessary to employ estimation or imputation techniques to account for missing data. These techniques are most effective when the response rate is relatively high. Some of the estimation methods depend on knowledge of prior establishment reporting, while other techniques rely on external information to estimate the missing data. When survey forms are received after the current publication has been completed, the forms are edited, necessary imputations are made for missing data, and the survey data base is updated. The revised data are reported in later publications.

Protection of Proprietary Data.—The USGS relies on the cooperation of the U.S. minerals industry to provide the mineral data that are presented in this and other USGS publications. Without a strong response to survey requests, the USGS would not be able to present reliable statistics. The USGS, in turn, respects the proprietary nature of the data received from the individual companies and establishments. To ensure that proprietary rights will not be violated, the USGS analyzes each of the aggregated statistics to determine if the data reported by an individual establishment can be deduced from the aggregated statistics. If, for example, there are only two significant producers of a commodity in a given State, the USGS will not publish the State total because either producer could readily estimate the production of the other. It is this obligation to protect proprietary information that results in the "Withheld" or "W" entries in the published tables. However, if a company gives permission in writing, the USGS will publish the data as long as the data from other respondents are protected from disclosure.

International Data

International data are collected by USGS country specialists and data assistants. The data are gathered from various sources, including published reports of foreign Government mineral and statistical agencies, international organizations, the U.S. Department of State, the United Nations, the Organization of Petroleum Exporting Countries, and personal contact by specialists traveling abroad. Each February, an annual "Minerals Questionnaire" is sent to foreign organizations asking them to provide estimates of mineral production for the host country for the preceding year. Missing data are estimated by USGS country specialists based on historical trends and on specialists' knowledge of current production capabilities in each country.

Publications

The USGS disseminates current and historical minerals information through a broad range of printed publications.

The Minerals Yearbook summarizes annually, on a calendar-year basis, the significant economic and technical developments in the mineral industries. Three separate volumes are issued each year: Volume I, Metals and Minerals; Volume II, Area Reports, Domestic; and Volume III, Area Reports, International. Chapters in Volume I are issued separately as annual Mineral Industry Surveys (MIS) before the bound volume is available. Volume I of the Minerals Yearbook presents, by mineral commodity, salient statistics on production, trade, consumption, reserves, and other measures of economic activity. Volume II of the Minerals Yearbook reviews the U.S. minerals industry by State and island possessions. Volume III of the Minerals Yearbook is published as four separate regional reports covering more than 190 foreign countries.. The regional reports contain individual country chapters that examine the mining, refining, processing, and use of minerals in each country in the region and how they relate to U.S. industry.

The MIS contain timely statistical and economic data on minerals. The surveys are designed to keep Government agencies and the public, particularly the mineral industry and the business community, informed of trends in the production, distribution, inventories, and consumption of minerals. Frequency of issue depends on the demand for current data. The MIS are released monthly, quarterly, semiannually, and annually.

Mineral Commodity Summaries, an up-to-date summary of about 80 nonfuel mineral commodities, is the earliest Government publication to furnish estimates covering the previous year's nonfuel mineral industry data. It contains information on the domestic industry structure, Government programs, tariffs, 5-year salient domestic statistics, and a summary of international mining news.

Metal Industry Indicators, published monthly, contains indexes that measure the current and future performance of five U.S. metal industries. For each of the five industries, a composite coincident index and a composite leading index have been developed based on procedures and data similar to those used to construct the Conference Board's coincident and leading cyclical indicators for the national economy.

The MIS and the Metal Industry Indicators are available at no charge from Publication Distribution, Cochrans Mill Road, P.O. Box 18070, Pittsburgh, PA 15236, (412) 892-4338.

Minerals Yearbooks and Mineral Commodity Summaries may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, (202) 512-1800.

Mineral Commodity Summaries also may be purchased from the National Technical Information Service, Springfield, VA 22161, 1-800-553-NTIS (in Virginia and foreign countries: 1-703-487-4650).

Some Minerals Information publications are also available on a CD-ROM format. The CD-ROM is updated three times per year. It is available from the Government Printing Office at the address and phone number listed above.

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Electronic Data Dissemination

In addition to the USGS's printed publications, current information on minerals and mineral-related publications from the USGS is now available through an easy-to-use automated fax response system. The MINES FaxBack service allows callers to retrieve information and order some publications for delivery to their fax machines in minutes, 24 hours per day, 7 days per week. MINES FaxBack makes monthly, quarterly, and annual MIS publications available to the public at the same time they are forwarded to the printer.

MINES FaxBack works from any Group III-compatible fax machine equipped with a touch-tone telephone (either a built-in handset with touch-tone capability or a separate touch-tone telephone plugged into the fax machine's phone jack). After calling MINES FaxBack, the requestor is guided by a series of voice messages that assist the caller in ordering the desired documents. The caller pays for the phone call that also includes the time needed to deliver the requested document to the caller's fax machine.

To access the MINES FaxBack System, use a touch-tone handset attached to a fax machine or connect a touch-tone telephone to the fax machine's telephone jack and dial (703) 648-4999. Listen to the menu options and select an option using the touch-tone telephone. After completing a selection, press the start button on the fax machine.

The USGS also has a minerals information page on the World Wide Web detailing publications, information products, and contacts for minerals information. To access the page, use Netscape or a similar Web browser. The URL is http://minerals.er.usgs.gov/minerals/. The page also contains links to other mining-related pages on the Internet.

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FIGURE 1
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Unless authorization is granted in the section above the signature, the data furnished in this report will be treated in confidence by the Department of the Interior, except that they may be disclosed to Federal defense agencies, or to the Congress upon official request for appropriate purposes. Unless objection is made in writing to the USGS, the information furnished in this report may be disclosed to the respondent's State Geological Survey (or similar State Agency) if the State has appropriate safeguards to prevent disclosing company proprietary data.

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FACSIMILE NUMBER
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This survey is exempt from requirements of the Paperwork Reduction Act (44 U.S.C. 35) and does not require clearance from OMB. The USGS relies on your voluntary and timely response to assure that its information is complete and accurate. This form is designed to supplement Form 6-1151-MA. Please return this form in the enclosed envelope or fax to the above toll-free number. Complete a separate form for each mineral establishment that was active during the reporting period. A mineral establishment is defined as a single physical location where mineral operations are conducted; for example, a mine only, a mine and preparation plant, or a preparation plant only. If you do not have exact data, please enter your best estimates and mark with an /e. Use zero (0) when appropriate. Do not report decimals or fractions. Round to the nearest whole number. If you have nothing to report, please complete "Location of plant", sign, and return the form. Please do not make entries in shaded areas.

Please use the space for "Remarks" to provide any specific information that will help us in the use or interpretation of the data. Any statement on the effect of changes in economic conditions upon the reporting establishment will be useful. Additional forms are available upon request. If you have any questions concerning completion of this form, please contact the Mineral Commodities Data Unit, U.S. Geological Survey, 985 National Center, Reston, VA 20192, Telephone (703) 648-7960.

1. Location of plant: City or town _____ State _____

2. Zinc consumed in manufacture of rolled zinc.
This is a measure of zinc entering the rolling mill for the first time. Do not include clippings originating from manufacturing finished products (coin blanks, battery cans, etc.) in your own fabricating plant.

Type of zinc consumed (1)	Code	Stocks at plant at beginning of year *(gross weight - pounds)* (2)	Receipts during year *(gross weight - pounds)* (3)	Melted or consumed during year *(gross weight - pounds)* (4)	Stocks at plant end of year *(gross weight -pounds)* (5)
Zinc scrap	301				
Slab zinc	302				
Other *(specify)*_____	303				

3. Production and stocks of rolled zinc, by type.

Item (1)	Code	Stocks at plant at beginning of year *(gross weight - pounds)* (2)	(3)	Production during year *(gross weight - pounds)* (4)	Stocks at plant end of year *(gross weight - pounds)* (5)
Strip foil	402				
Rod and wire	405				
Coin alloy	406				
Other *(specify)*_____	407				
TOTAL	408				

Remarks:

Name of person to be contacted regarding this report			Tel. area code	No.	Ext.
Address	No.	Street	City	State	ZIP Code

May tabulations be published which could indirectly reveal the data reported above? ☐ (1) Yes ☐ (2) No

Signature	Title	Date

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PRELIMINARY STATISTICAL SUMMARY

By Stephen D. Smith

This preliminary report summarizes data on crude nonfuel mineral production[1] for the United States, its island possessions, and the Commonwealth of Puerto Rico.

Although crude mineral production may be measured at any of several stages of extraction and processing, the stage of measurement used in this annual report is what is termed "mine output." This term refers to minerals or ores in the form in which they are first extracted from the ground, but customarily may include the output from auxiliary processing at or near the mines.

Because of inadequacies in the statistics available, some series deviate from the foregoing definition. For copper, gold, lead, silver, tin, and zinc, the quantities shown are recorded on a mine basis (as the recoverable content of ore sold or treated). However, the values assigned to the quantities are based on the average selling price of refined metal, not the mine value. Mercury is measured as recovered metal and valued at the average New York price for the metal. Values shown are in current dollars, with no adjustments made to compensate for changes in the purchasing power of the dollar.

The preliminary total value of all nonfuel mineral production in the United States increased more than 2% to $39.6 billion in 1997, with metals decreasing less than 1% to $12.9 billion and industrial minerals increasing almost 3.6% to $26.7 billion over that of 1996. Ten of the mineral commodities produced in the United States in 1997 had an individual total production value greater than $1 billion. These commodities, in descending order, were stone (crushed), cement (portland), copper, sand and gravel (construction), gold, iron ore, lime, clays (kaolin), phosphate rock, and zinc. They composed almost 81% of the U.S. total production *(table 1)*.

In 1997, 11 States produced nonfuel mineral commodities with individual total production values of greater than $1 billion. These States, in descending order, were Arizona, Nevada, California, Georgia, Utah, Florida, Texas, Minnesota, Michigan, Missouri, and Pennsylvania. They composed almost 56% of the U.S. total production (*table 4*).

---

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of June 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION 1/ IN THE UNITED STATES 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995		1996		1997 p/	
		Quantity	Value	Quantity	Value	Quantity	Value
Metals:							
Antimony 3/	metric tons	262	W	242	W	W	W
Beryllium concentrates	do.	5,040	6	5,260	6	5,300	6
Copper 4/		1,850	5,640,000	1,920	4,610,000	1,920	4,570,000
Gold 4/	kilograms	317,000	3,950,000	321,000 r/	4,030,000 r/	341,000	3,720,000
Iron ore, usable		61,100	1,730,000	62,200	1,770,000	61,600	1,750,000
Iron oxide pigments, crude	metric tons	51,700	6,720	44,700	6,990	46,000	7,240
Lead 4/	do.	386,000	359,000	426,000	459,000	440,000	456,000
Magnesium metal	do.	142,000	476,000	133,000	455,000	120,000	378,000
Molybdenum 3/	do.	W	W	57,900	456,000	58,500	467,000
Nickel ore	do.	1,560	W	1,330	W	-- 5/	--
Palladium metal	kilograms	5,260	22,000	6,100	25,500	8,340	46,700
Platinum	do.	1,590	20,800	1,840	23,500	2,500	31,700
Rare-earth metal concentrates	metric tons	22,200	W	20,400	W	20,000	W
Silver 4/	do.	1,560	259,000	1,570	263,000	1,600	224,000
Zinc 4/	do.	614,000	756,000	600,000	676,000	607,000	1,080,000
Combined value of bauxite, manganiferous ore, mercury, titanium concentrates, tungsten, vanadium, zircon concentrates and values indicated by symbol W		XX	812,000	XX	190,000	XX	188,000
Total		XX	14,000,000	XX	13,000,000 r/	XX	12,900,000
Industrial minerals:							
Asbestos	metric tons	10,200	W	9,550	W	9,070	W
Barite		543	10,400	662	14,700	700	17,500
Boron minerals	metric tons	1,190,000	560,000	1,150,000	519,000	622,000 6/	503,000
Bromine	do.	218,000	186,000	227,000	150,000	250,000	247,000
Cement:							
Masonry		3,600	307,000	3,470	321,000 e/	3,540	334,000 e/
Portland		73,300	4,920,000	75,800	5,310,000 e/	77,300	5,520,000 e/
Clays:							
Ball		993	45,500	973	43,100	1,030	50,700
Bentonite		3,820	138,000	3,740	134,000	3,780	133,000
Common		25,600	151,000	26,200	144,000	26,400	164,000
Fire		583	12,800	505	10,700	403	9,990
Fuller's earth		2,640	269,000	2,600	278,000	2,570	249,000
Kaolin		9,480	1,110,000	9,120	1,100,000	8,990	1,110,000
Diatomite		687	171,000	698	176,000	705	178,000
Feldspar	metric tons	882,000	37,400	890,000	39,400	930,000	41,900
Fluorspar	do.	51,400	W	8,180	W	NA	NA
Garnet, industrial	do.	53,000	9,690	68,200	10,200	70,800	7,580
Gemstones, natural		NA	48,700	NA	43,600	NA	38,200
Gypsum, crude		16,600	121,000	17,500	124,000	17,000	121,000
Helium:							
Crude	million cubic meters	36	32,100	37	33,100	38	33,900
Grade-A	do.	99	196,000	97	193,000	100	198,000
Iodine, crude	metric tons	1,220	12,500	1,270	14,600	1,330	24,000
Lime		18,500	1,100,000	19,100	1,140,000	19,300	1,150,000
Mica, crude		108	5,630	97	7,820	92	8,430
Peat		660	17,000	640	18,500	617	15,900
Perlite, crude	metric tons	700,000	21,600	684,000	21,300	703,000	22,400
Phosphate rock, marketable		43,500	947,000	45,400	1,060,000	46,300	1,090,000
Potash, K_2O		2,880	284,000	2,960	299,000	2,990	318,000
Pumice and pumicite	metric tons	529,000	13,200	612,000	14,800	538,000	14,200
Salt		40,800	1,000,000	42,900	1,060,000	41,400	958,000
Sand and gravel:							
Construction		910,000	3,910,000	914,000	4,000,000	961,000	4,290,000
Industrial		28,200	502,000	27,800	497,000	27,900	510,000
Silica stone 7/	metric tons	374	W	410	3,810	NA	NA
Sodium compounds:							
Soda ash		10,100	829,000	10,200	926,000	10,400	822,000
Sodium sulfate, natural		327	27,700	306	27,200	320	28,800
Stone, crushed 8/		1,260,000	6,750,000	1,330,000	7,180,000	1,390,000	7,720,000
Sulfur, Frasch		3,070	207,000	W	W	W	W

See footnotes at end of table.

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TABLE 1—Continued
NONFUEL RAW MINERAL PRODUCTION 1/ IN THE UNITED STATES 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Tripoli	metric tons	80,100	10,500	79,600	18,400	NA	NA
Vermiculite, crude	do.	171,000	W	W	W	W	W
Zeolites	do.	46,800	NA	39,300	NA	NA	NA
Combined value of brucite, emery, greensand marl, kyanite, lithium minerals, magnesite, magnesium compounds, olivine, staurolite, stone (dimension), talc and pyrophyllite, wollastonite and values indicated by symbol W		XX	626,000	XX	818,000	XX	743,000
Total		XX	24,600,000	XX	25,800,000	XX	26,700,000
Grand total		XX	38,600,000	XX	38,700,000	XX	39,600,000

e/ Estimated. p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value." XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Content of ore and concentrate.

4/ Recoverable content of ores, etc.

5/ Quantity of local ore fed to smelter after rejection of lower grade material. The Nickel Mountain Mine reportedly was idle all of 1997 because of disappointing prices for nickel ore. However, the smelter operated at full capacity. The smelter normally uses lateritic ore imported from New Caledonia in addition to lateritic ore mined on Nickel Mountain. In a normal year, the value reflects the grade of the local ore, the projected average unit customs value for competing ore imported from New Caledonia, and the projected average reported by the London Metal Exchange ($6,931 per metric ton nickel in 1997).

6/ Weight reported as B_2O_3 and is not comparable to prior years.

7/ Includes grindstones, pulpstones, and sharpening stones; excludes mill liners and grinding pebbles.

8/ Excludes abrasive stone and bituminous limestone and sandstone; all included elsewhere in table.

TABLE 2
NONFUEL RAW MINERALS PRODUCED IN THE UNITED STATES, BY COMMODITY AND STATES IN 1997 p/

(Based on quantity unless otherwise noted)

Mineral	Principal States	Other States
Antimony 1/	ID	
Asbestos	CA	
Barite	NV, GA, MO, TN	
Beryllium concentrate	UT	
Boron minerals	CA	
Bromine	AR and MI	
Brucite	NV	
Cement:		
Masonry	FL, IN, AL, SC, PA	AZ, AR, CA, CO, GA, HI, ID, IA, KS, KY, ME, MD, MI, MO, MT, NE, NY, OH, OK, SD, TN, TX, UT, VA, WA, WV.
Portland	CA, TX, PA, MI, MO	All other States except AK, CT, DE, LA, MA, MN, NH, NJ, NC, ND, RI, VT, WI.
Clays:		
Ball	TN, TX, KY, MS, IN	MO.
Bentonite	WY, AL, MT, MS, CA	AZ, CO, NV, OR, UT.
Common	AL, NC, TX, OH, GA	All other States except AK, DE, HI, ID, NV, NH, RI, VT, WI.
Fire	MO, OH, AL, CA, AR	MT and NM.
Fuller's earth	GA, FL. MS, IL, MO	CA, KS, NV, TN, TX, VA.
Kaolin	GA, AL, SC, AR, CA	CO, FL, NV, NC, PA, TX.
Copper 1/	AZ, UT, NM, NV, MT	AK, ID, MO, WI.
Diatomite	CA, NV, OR, WA	
Feldspar	NC, CA, VA, GA, OK	ID and SD.
Garnet, industrial	ID, NY, MT	
Gemstones, natural 2/	TN, KY, AZ, AR, AL	All other States.
Gold 1/	NV, UT, CA, SD, AK	AZ, CO, ID, MT, NM, SC, WA, WI.
Greensand marl	NJ	
Gypsum, crude	OK, TX, IA, MI, NV	AZ, AR, CA, CO, IN, KS, LA, NM, NY, OH, SD, UT, VA, WA, WY.
Helium:		
Crude	KS, TX, OK	
Grade-A	KS, WY, TX, UT, CO	OK.
Iodine, crude	OK	
Iron ore, usable	MN, MI, MO, NM, SD	CA and MT.
Iron oxide pigments, crude	MI, MO, GA, VA, AL	AZ.

See footnotes at end of table.

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TABLE 2--Continued
NONFUEL RAW MINERALS PRODUCED IN THE UNITED STATES, BY COMMODITY AND STATES IN 1997 p/

(Based on quantity unless otherwise noted)

Mineral	Principal States	Other States
Kyanite	VA	
Lead 1/	MO, AK, ID, MT, CO	NY and TN.
Lime	MO, OH, KY, AL, PA	All other States except AK, CT, DE, FL, GA, HI, KS, ME, MD, MS, NH, NJ, NM, NY, NC, RI, SC, VT.
Lithium minerals	NC and NV	
Magnesite	NV	
Magnesium compounds	MI, CA, FL, UT, DE	TX.
Magnesium metal	TX, UT, WA	
Mercury	NV, CA, UT	
Mica, crude	NC, NM, GA, SD, SC	
Molybdenum	AZ, CO, UT, ID, MT	NM.
Nickel ore	OR	
Olivine	NC and WA	
Palladium metal	MT	
Peat	FL, MI, IL, IN, IA	CO, ME, MA, MN, MT, NJ, NY, NC, ND, OH, PA, SC, WA, WV, WI.
Perlite, crude	NM, AZ, CA, NV, ID	
Phosphate rock, marketable	FL, ID, NC, UT	
Platinum metal	MT	
Potash, K_2O	NM, UT, MI	
Pumice and pumicite	OR, NM, CA, ID, AZ	KS.
Rare-earth metal concentrates	CA	
Salt	LA, TX, OH, NY, KS	AL, AZ, CA, MI, NV, NM, OK, UT, WV.
Sand and gravel:		
Construction	CA, MI, TX, OH, MN	All other States except HI.
Industrial	IL, MI, CA, WI, NJ	All other States except AK, CT, DE, HI, KY, ME, NH, NM, OR, SD, UT, VT, WY.
Silver 1/	NV, ID, AK, AZ, UT	CA, CO, MO, MT, NM, NY, SC, SD, WI.
Sodium compounds:		
Soda ash	WY and CA	
Sodium sulfate, natural	CA and TX	
Staurolite	FL	
Stone:		
Crushed	PA, TX, MO, FL, IL	All other States except DE and ND.
Dimension	IN, WI, VT, GA, TX	All other States except AK, DE, FL, HI, IL, IA, KY, LA, MS, NE, NV, NJ, ND, OR, RI, WY.
Sulfur, Frasch	LA and TX	
Talc and pyrophyllite	MT, TX, VT, NY, NC	CA, GA, OR, VA.
Titanium concentrates:		
Ilmenite	FL and CA	
Rutile	FL	
Vanadium 1/	ID	
Vermiculite, crude	SC and VA	
Wollastonite	NY	
Zinc 1/	AK, TN, NY, MO, MT	CO, ID, IL.
Zircon concentrates	FL	

p/ Preliminary.
1/ Content of ores, etc.
2/ Principal producing States based on value.
3/ Includes grindstones, pulpstones, and sharpening stones; excludes mill liners and grinding pebbles.

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TABLE 3

VALUE OF NONFUEL RAW MINERAL PRODUCTION IN THE UNITED STATES AND PRINCIPAL NONFUEL MINERALS PRODUCED IN 1997 p/ 1/

State	Value (thousands)	Rank	Percent of U.S. total	Principal minerals, in order of value
Alabama	$805,000	18	2.03	Cement (portland), stone (crushed), lime, sand and gravel (construction), cement (masonry).
Alaska	942,000	15	2.38	Zinc, gold, lead, sand and gravel (construction), silver.
Arizona	3,520,000	1	8.88	Copper, sand and gravel (construction), molybdenum, lime.
Arkansas	535,000	25	1.35	Bromine, stone (crushed), cement (portland), sand and gravel (construction), sand and gravel (industrial).
California	2,810,000	3	7.10	Cement (portland), sand and gravel (construction), Boron (B_2O_3), stone (crushed), gold.
Colorado	536,000	24	1.35	Sand and gravel (construction), cement (portland), gold, molybdenum, stone (crushed).
Connecticut 2/	64,800	46	0.16	Stone (crushed), sand and gravel (construction), stone (dimension), clays (common), gemstones.
Delaware 2/	6,490	50	0.02	Magnesium compounds, sand and gravel (construction), gemstones.
Florida	1,740,000	6	4.41	Phosphate rock, stone (crushed), cement (portland), sand and gravel (construction), titanium (ilmenite).
Georgia	1,770,000	4	4.47	Clays (kaolin), stone (crushed), cement (portland), clays (fuller's earth), sand and gravel (construction).
Hawaii 2/	99,900	43	0.25	Stone (crushed), cement (portland), cement (masonry), gemstones.
Idaho	477,000	30	1.20	Phosphate rock, gold, sand and gravel (construction), molybdenum, silver.
Illinois	880,000	17	2.22	Stone (crushed), cement (portland), sand and gravel (construction), sand and gravel (industrial), lime.
Indiana	640,000	21	1.62	Stone (crushed), cement (portland), sand and gravel (construction), lime, cement (masonry).
Iowa	493,000	29	1.25	Stone (crushed), cement (portland), sand and gravel (construction), gypsum (crude), lime.
Kansas	547,000	23	1.38	Cement (portland), salt, stone (crushed), helium (Grade-A), sand and gravel (construction).
Kentucky	476,000	31	1.20	Stone (crushed), lime, cement (portland), sand and gravel (construction), clays (ball).
Louisiana	379,000	35	0.96	Salt, sulfur (Frasch), sand and gravel (construction), stone (crushed), sand and gravel (industrial).
Maine	88,200	44	0.22	Sand and gravel (construction), cement (portland), stone (crushed), peat, cement (masonry).
Maryland	401,000	33	1.01	Stone (crushed), cement (portland), sand and gravel (construction), cement (masonry), stone (dimension).
Massachusetts	213,000	39	0.54	Stone (crushed), sand and gravel (construction), stone (dimension), lime, clays (common).
Michigan	1,560,000	9	3.94	Cement (portland), iron ore (usable), sand and gravel (construction), magnesium compounds, stone (crushed).
Minnesota	1,600,000	8	4.05	Iron ore (usable), sand and gravel (construction), stone (crushed), sand and gravel (industrial), stone (dimension).
Mississippi	137,000	42	0.35	Sand and gravel (construction), cement (portland), clays (fuller's earth), stone (crushed), clays (bentonite).
Missouri	1,320,000	10	3.33	Stone (crushed), lead, cement (portland), lime, zinc.
Montana	498,000	28	1.26	Copper, gold, cement (portland), palladium metal, molybdenum.
Nebraska	161,000	41	0.41	Cement (portland), sand and gravel (construction), stone (crushed), cement (masonry), clays (common).
Nevada	3,030,000	2	7.66	Gold, copper, silver, sand and gravel (construction), diatomite.
New Hampshire 2/	60,200	47	0.15	Sand and gravel (construction), stone (crushed), stone (dimension), gemstones.
New Jersey	296,000	37	0.75	Stone (crushed), sand and gravel (construction), sand and gravel (industrial), greensand marl, peat.
New Mexico	994,000	13	2.51	Copper, potash (K_2O), sand and gravel (construction), cement (portland), perlite (crude).
New York	904,000	16	2.28	Stone (crushed), cement (portland), salt, sand and gravel (construction), zinc.
North Carolina	756,000	20	1.91	Stone (crushed), phosphate rock, sand and gravel (construction), clays (common), sand and gravel (industrial).
North Dakota	31,600	48	0.08	Sand and gravel (construction), lime, clays (common), sand and gravel (industrial), gemstones.
Ohio	984,000	14	2.49	Stone (crushed), sand and gravel (construction), salt, lime, cement (portland).
Oklahoma	411,000	32	1.04	Stone (crushed), cement (portland), sand and gravel (construction), sand and gravel (industrial), iodine (crude).
Oregon	272,000	38	0.69	Sand and gravel (construction), stone (crushed), cement (portland), diatomite, lime.
Pennsylvania 2/	1,240,000	11	3.12	Stone (crushed), cement (portland), lime, sand and gravel (construction), cement (masonry).
Rhode Island 2/	22,600	49	0.06	Sand and gravel (construction), stone (crushed), sand and gravel (industrial), gemstones.
South Carolina	507,000	27	1.28	Cement (portland), stone (crushed), gold, sand and gravel (construction), cement (masonry).
South Dakota	339,000	36	0.86	Gold, cement (portland), stone (crushed), sand and gravel (construction), lime.
Tennessee	786,000	19	1.99	Stone (crushed), zinc, cement (portland), sand and gravel (construction), clays (ball).
Texas	1,700,000	7	4.29	Cement (portland), stone (crushed), sand and gravel (construction), magnesium metal, salt.
Utah	1,760,000	5	4.45	Copper, gold, molybdenum, magnesium metal, sand and gravel (construction).
Vermont 2/	68,200	45	0.17	Stone (dimension), stone (crushed), sand and gravel (construction), talc and pyrophyllite, gemstones.
Virginia	600,000	22	1.51	Stone (crushed), sand and gravel (construction), cement (portland), lime, kyanite.
Washington	522,000	26	1.32	Sand and gravel (construction), magnesium metal, stone (crushed), cement (portland), gold.
West Virginia	190,000	40	0.48	Stone (crushed), cement (portland), sand and gravel (industrial), lime, salt.
Wisconsin	389,000	34	0.98	Stone (crushed), sand and gravel (construction), copper, sand and gravel (industrial), lime.
Wyoming	996,000	12	2.52	Soda ash, clays (bentonite), helium (Grade-A), cement (portland), stone (crushed).
Undistributed	29,800	XX	0.08	
Total	39,600,000	XX	100.00	

p/ Preliminary. XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Partial total; excludes values that must be concealed to avoid disclosing company proprietary data. Concealed values included with "Undistributed."

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TABLE 4
VALUE OF NONFUEL RAW MINERAL PRODUCTION PER CAPITA AND PER SQUARE KILOMETER IN 1997, BY STATE p/ 1/

State	Area (square kilometers)	Population (thousands)	Total value (thousands)	Per capita		Per square kilometer	
				Dollars	Rank	Dollars	Rank
Alabama	134,000	4,250	$805,000	189	15	6,010	21
Alaska	1,530,000	604	942,000	1,560	3	615	49
Arizona	295,000	4,220	3,520,000	834	5	11,900	3
Arkansas	138,000	2,480	535,000	215	13	3,880	28
California	411,000	31,600	2,810,000	89	33	6,840	17
Colorado	270,000	3,750	536,000	143	19	1,990	41
Connecticut	13,000	3,270	64,800 2/	20	49	4,990	25
Delaware	5,290	717	6,490 2/	9	50	1,230	44
Florida	152,000	14,200	1,740,000	123	23	11,500	5
Georgia	153,000	7,200	1,770,000	246	12	11,600	4
Hawaii	16,800	1,190	99,900 2/	84	37	5,960	22
Idaho	216,000	1,160	477,000	410	9	2,200	40
Illinois	146,000	11,800	880,000	74	40	6,030	20
Indiana	93,700	5,800	640,000	110	25	6,820	18
Iowa	146,000	2,840	493,000	174	16	3,380	29
Kansas	213,000	2,570	547,000	213	14	2,570	36
Kentucky	105,000	3,860	476,000	123	22	4,550	26
Louisiana	124,000	4,340	379,000	87	35	3,070	31
Maine	86,200	1,240	88,200	71	41	1,020	47
Maryland	27,100	5,040	401,000	79	38	14,800	1
Massachusetts	21,500	6,070	213,000	35	47	9,950	9
Michigan	152,000	9,550	1,560,000	164	17	10,300	8
Minnesota	219,000	4,610	1,600,000	348	10	7,330	12
Mississippi	124,000	2,700	137,000	51	43	1,110	45
Missouri	181,000	5,320	1,320,000	248	11	7,300	13
Montana	381,000	870	498,000	572	7	1,310	43
Nebraska	200,000	1,640	161,000	99	29	805	48
Nevada	286,000	1,530	3,030,000	1,980	2	10,600	6
New Hampshire	24,000	1,150	60,200 2/	53	42	2,510	37
New Jersey	20,200	7,950	296,000	37	46	14,700	2
New Mexico	315,000	1,690	994,000	590	6	3,160	30
New York	127,000	18,100	904,000	50	44	7,100	16
North Carolina	136,000	7,200	756,000	105	26	5,540	24
North Dakota	183,000	641	31,600	49	45	172	50
Ohio	107,000	11,200	984,000	88	34	9,200	10
Oklahoma	181,000	3,280	411,000	125	21	2,270	39
Oregon	251,000	3,140	272,000	87	36	1,080	46
Pennsylvania	117,000	12,100	1,240,000 2/	102	28	10,500	7
Rhode Island	3,140	990	22,600 2/	23	48	7,200	15
South Carolina	80,600	3,670	507,000	138	20	6,290	19
South Dakota	200,000	729	339,000	465	8	1,700	42
Tennessee	109,000	5,260	786,000	150	18	7,200	14
Texas	691,000	18,700	1,700,000	91	31	2,460	38
Utah	220,000	1,950	1,760,000	902	4	8,010	11
Vermont	24,900	585	68,200 2/	117	24	2,740	34
Virginia	106,000	6,620	600,000	91	32	5,680	23
Washington	176,000	5,430	522,000	96	30	2,960	33
West Virginia	62,800	1,830	190,000	104	27	3,030	32
Wisconsin	145,000	5,120	389,000	76	39	2,670	35
Wyoming	253,000	480	996,000	2,070	1	3,930	27
Undistributed	XX	XX	29,800	XX	XX	XX	XX
Total or average	9,370,000 3/	262,000 3/	39,600,000	151	XX	4,220	XX

p/ Preliminary. XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Partial total; excludes values that must be concealed to avoid disclosing company proprietary data. Concealed values included with "Undistributed."

3/ Excludes Washington, DC (which has no mineral production), with an area of 179 square kilometers and a population of 554,000.

Sources: U.S. Geological Survey and Bureau of the Census.

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TABLE 5
NONFUEL RAW MINERAL PRODUCTION IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Alabama:							
Cement:							
Masonry		306	30,700	309	32,000 e/	315	33,300 e/
Portland		4,090	285,000	4,330	326,000 e/	4,410	339,000 e/
Clays:							
Bentonite		154	4,700	166	5,060	166	5,060
Common		2,080	18,600	2,290	17,100	2,670	20,500
Fire		80	3,120	52	2,800	53	2,840
Kaolin		373	7,220	254	W	471	W
Gemstones		NA	3,000 r/	NA	2,000	NA	1,980
Lime		1,730	105,000	1,860	116,000	1,880	117,000
Sand and gravel:							
Construction		11,900	49,400	13,800	60,600	13,600	61,300
Industrial		479	5,940	799	8,380	780	8,380
Stone, crushed		33,600	174,000	38,900	198,000	38,000	200,000
Combined value of bauxite (1995), iron oxide pigments (crude, 1997), salt, stone (dimension limestone and sandstone), and values indicated by symbol W		XX	6,810	XX	9,930	XX	15,200
Total		XX	693,000 r/	XX	778,000	XX	805,000
Alaska:							
Gemstones		NA	10	NA	11	NA	10
Gold 3/ 4/	kilograms	4,410	56,000	5,020	61,000	16,300	175,000
Sand and gravel, construction		13,700	48,500	9,380	35,900	10,000	39,300
Silver 3/	metric tons	109	18,100	W	W	W	W
Stone, crushed 5/		2,430 r/	14,500 r/	2,600	16,500	2,600	17,000
Zinc 3/	metric tons	321,000	395,000	W	W	W	W
Combined values of copper (1996-97), lead, stone [crushed dolomite, granite, and limestone (1997), crushed dolomite and limestone (1995-96)], zinc, and values indicated by symbol W		XX	(6/)	XX	499,000	XX	711,000
Total		XX	538,000 r/ 7/	XX	613,000	XX	942,000
Arizona:							
Clays:							
Bentonite		21	W	W	W	W	W
Common		98	449	104	W	91	W
Copper 3/		1,170	3,560,000	1,240	2,980,000	1,230	2,930,000
Gemstones		NA	3,230	NA	2,360	NA	3,220
Gold 3/	kilograms	1,920	23,900	1,740	21,800	W	W
Iron oxide pigments, crude	metric tons	68	90	W	W	W	W
Sand and gravel:							
Construction		40,100	201,000	41,900	199,000	40,400	197,000
Industrial		334	2,910	323	2,890	319	3,220
Silver 3/	metric tons	220	36,400	188	31,300	159	22,300
Stone, crushed		5,520	32,600	6,800	40,600	6,100	38,000
Combined value of cement, gypsum (crude), lime, molybdenum, perlite (crude), pumice and pumicite, salt, stone (dimension sandstone), and values indicated by symbol W		XX	331,000	XX	308,000	XX	325,000
Total		XX	4,190,000	XX	3,580,000	XX	3,520,000
Akansas:							
Clays:							
Common		973	2,920	939	2,390	1,170	2,160
Kaolin		182	4,890	161	W	164	W
Gemstones		NA	4,890	NA	3,050	NA	2,800
Sand and gravel, construction		11,600	48,300	11,000	43,500	11,900	48,400
Silica stone 8/	metric tons	W	W	398	3,800	NA	NA
Stone:							
Crushed		25,500	169,000	26,400	158,000	27,000	162,000
Dimension	metric tons	22,000	2,010	W	W	W	W

See footnotes at end of table.

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TABLE 5--Continued
NONFUEL RAW MINERAL PRODUCTION IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Arkansas--Continued:							
Combined value of bromine, cement, clays (fire), gypsum (crude), lime, sand and gravel (industrial), stone [dimenson limestone, marble, and sandstone (1996-97)], tripoli, and values indicated by symbol W		XX	260,000	XX	225,000	XX	320,000
Total		XX	492,000	XX	435,000	XX	535,000
California:							
Asbestos	metric tons	10,200	W	9,550	W	9,070	W
Boron minerals		1,190	560,000	1,150	519,000	622 9/	503,000
Cement:							
Masonry		154	11,200	198	14,500 e/	202	15,000 e/
Portland		9,360	565,000	9,910	616,000 e/	10,100	641,000 e/
Clays:							
Bentonite		149	14,000	148	13,900	149	14,100
Common		1,420	14,500	1,340	12,600	1,310	11,700
Fire		11	311	60	W	33	397
Fuller's earth		224	W	224	W	225	33,300
Diatomite		318	W	W	W	W	W
Gemstones		NA	490	NA	507	NA	515
Gold 3/	kilograms	25,600	319,000	23,800	299,000	21,000	230,000
Lime		228	15,600	208	17,800	210	18,000
Rare-earth metal concentrates	metric tons	22,200	W	20,400	W	20,000	W
Sand and gravel:							
Construction		98,400	542,000	103,000	583,000	110,000	634,000
Industrial		1,710	38,300	1,760	40,500	1,780	42,300
Silver 3/	metric tons	14	2,240	22	3,610	22	3,140
Stone:							
Crushed		43,700 5/	268,000 5/	46,700	295,000	47,300	308,000
Dimension	metric tons	27,300	6,660	28,600	7,020	28,800	7,060
Combined value of clays (kaolin), feldspar, gypsum (crude), iron ore (usable), magnesium compounds, mercury, perlite (crude), potash (1995-96), pumice and pumicite, salt, soda ash, sodium sulfate (natural), stone [crushed dolomite and shell (1995)], talc and pyrophyllite, titanium concentrates [ilmenite (1996-97)], tungsten (1995), and values indicated by symbol W		XX	399,000	XX	408,000	XX	351,000
Total		XX	2,760,000	XX	2,830,000	XX	2,810,000
Colorado:							
Clays:							
Bentonite		(10/)	9	1	19	1	19
Common		288	2,040	317	2,320	283	1,860
Kaolin		6	W	6	W	6	W
Gemstones		NA	245	NA	754	NA	W
Sand and gravel, construction		34,100	141,000	31,600	133,000	32,400	139,000
Silver 3/	metric tons	W	W	7	1,240	W	W
Stone:							
Crushed		9,000	58,500	9,940	64,900	10,200	70,000
Dimension	metric tons	17,800	2,640	23,900	3,330	24,000	3,350
Combined value of cement, gold, gypsum (crude), helium (Grade-A), lead, lime, molybdenum, peat, sand and gravel (industrial), zinc, and values indicated by symbol W		XX	366,000	XX	308,000	XX	322,000
Total		XX	570,000	XX	513,000	XX	536,000
Connecticut:							
Gemstones		NA	5	NA	5	NA	5
Sand and gravel, construction		6,410	37,500	6,380	26,900	6,210	26,800
Stone, crushed		6,070 5/	45,500 5/	6,720	55,000	4,600	38,000

See footnotes at end of table.

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TABLE 5--Continued
NONFUEL RAW MINERAL PRODUCTION IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Connecticut--Continued:							
Combined value of other industrial minerals		XX	9,470	XX	(6/)	XX	(6/)
Total		XX	92,500	XX	81,900 7/	XX	64,800 7/
Delaware:							
Gemstones		NA	1	NA	1	NA	1
Sand and gravel, construction		2,680	8,740	2,370	6,820	2,200	6,490
Total 7/		XX	8,750	XX	6,820	XX	6,490
Florida:							
Cement:							
Masonry		383	35,200	422	35,200 e/	431	36,600 e/
Portland		3,170	233,000	3,450	245,000 e/	3,510	255,000 e/
Clays:							
Fuller's earth		388	50,800	377	58,900	430	41,900
Kaolin		33	3,510	35	3,760	35	3,770
Gemstones		NA	W	NA	1	NA	1
Peat		294	5,390	298	5,550	244	4,690
Sand and gravel:							
Construction		19,300	69,300	18,500	68,800	19,300	73,500
Industrial		547	6,340	515	6,340	515	6,330
Stone, crushed		68,000	350,000	73,600 5/	394,000 5/	70,200 5/	380,000 5/
Combined value of clays (common), magnesium compounds, phosphate rock, staurolite, stone [crushed marl (1996-97)], titanium concentrates, zirconium concentrates, and value indicated by symbol W		XX	783,000	XX	947,000	XX	943,000
Total		XX	1,540,000	XX	1,760,000	XX	1,740,000
Georgia:							
Clays:							
Common		1,660	11,200	1,660	11,200	1,890	11,600
Fuller's earth		744	90,100	739	89,200	739	85,000
Kaolin		8,240	1,060,000	8,040	1,050,000	7,690	1,050,000
Gemstones		NA	51	NA	32	NA	594
Sand and gravel:							
Construction		5,780	23,100	6,520	24,500	6,370	24,500
Industrial		574	7,060	313	5,650	314	6,230
Stone:							
Crushed		60,600	373,000	63,400 5/	401,000 5/	65,000 5/	425,000 5/
Dimension	metric tons	132,000	27,700	89,600 5/	10,300 5/	90,100 5/	10,400 5/
Combined value of barite, bauxite (1995), cement, feldspar, iron oxide pigments (crude), mica (crude), and stone [crushed marble (1996-97), dimension marble (1996-97)], talc and pyrophyllite (1997)		XX	102,000	XX	148,000	XX	154,000
Total		XX	1,690,000	XX	1,740,000	XX	1,770,000
Hawaii:							
Cement:							
Masonry		5	501	5	500 e/	5	520 e/
Portland		357	35,500	312	32,000 e/	318	33,200 e/
Gemstones		NA	6/	NA	153	NA	129
Sand and gravel, construction		405	4,030	W	6/	W	6/
Stone, crushed		7,450 5/	73,500 5/	6,560	77,500	5,500	66,000
Total 7/		XX	114,000	XX	110,000	XX	99,900
Idaho:							
Antimony	metric tons	262	W	242	W	W	W
Clays, common		1	10	-	--	--	--
Gemstones		NA	346	NA	347	NA	352
Gold 3/	kilograms	8,850	110,000	10,800 r/	135,000 r/	10,300	111,000
Pumice and pumicite	metric tons	W	W	159,000	1,340	W	W
Sand and gravel:							
Construction		13,200	43,500	14,700	46,100	16,400	52,800
Industrial		501	8,720	646	8,510	663	8,540

See footnotes at end of table.

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TABLE 5--Continued
NONFUEL RAW MINERAL PRODUCTION IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Idaho--Continued:							
Silver 3/	metric tons	182	30,200	229	38,300	W	W
Stone, crushed 5/		3,210	14,000	3,960	20,200	4,500	23,600
Combined value of cement, copper, feldspar, garnet (industrial), lead, lime, molybdenum, perlite [crude (1997)], phosphate rock, stone [crushed miscellaneous, dimension quartzite (1995), dimension quartzite and miscellaneous (1996-97)], vanadium, zinc, and values indicated by symbol W		XX	303,000	XX	242,000	XX	280,000
Total		XX	510,000	XX	492,000 r/	XX	477,000
Illinois:							
Cement, portland		2,560	169,000	2,620	181,000 e/	2,670	189,000 e/
Clays:							
Common		503	1,220	115	736	128	642
Fuller's earth		332	W	330	W	330	W
Fluorspar	metric tons	51,400	W	8,180	W	NA	W
Gemstones		NA	269	NA	890	NA	1,200
Sand and gravel:							
Construction		36,100	147,000	34,600	144,000	37,500	160,000
Industrial		4,410	67,500	4,460	66,400	4,490	65,900
Stone, crushed		61,400	335,000	66,500	364,000	70,000	389,000
Combined value of barite (1995), copper (1995-96), lead (1995-96), lime, peat, silver (1995-96), tripoli (1995-96), zinc, and values indicated by symbol W		XX	107,000	XX	89,100	XX	74,500
Total		XX	828,000	XX	846,000	XX	880,000
Indiana:							
Cement, portland		2,330	143,000	2,350	153,000 e/	2,390	160,000 e/
Clays:							
Ball		38	W	38	W	38	W
Common		877	3,350	1,510	3,500	915	2,780
Gemstones		NA	36	NA	3	NA	3
Peat		17	281	W	W	W	W
Sand and gravel, construction		24,900	93,900	24,800	100,000	20,800	85,900
Stone:							
Crushed		49,200	234,000 5/	53,700 5/	254,000 5/	55,600 5/	272,000 5/
Dimension	metric tons	172,000	31,400	156,000 5/	24,500 5/	157,000 5/	24,600 5/
Combined value of cement (masonry), gypsum (crude), lime, sand and gravel (industrial), stone [crushed slate, dimension dolomite (1996-97)], and values indicated by symbol W		XX	82,700	XX	92,800	XX	94,700
Total		XX	589,000	XX	628,000	XX	640,000
Iowa:							
Cement, portland		2,340	161,000	2,390	187,000 e/	2,440	195,000 e/
Clays, common		322	1,590	478	1,180	479	1,110
Gemstones		NA	57	NA	481	NA	914
Gypsum, crude		2,240	13,800	2,090	12,800	2,030	14,400
Peat		5	77	W	W	W	W
Sand and gravel, construction		14,300	57,000	13,300	54,600	12,500	52,600
Stone, crushed		35,300	210,000	34,400	202,000	37,000	218,000
Combined value of cement (masonry), lime, sand and gravel (industrial), stone [dimension dolomite and sandstone (1995)], and values indicated by symbol W		XX	12,500	XX	11,100	XX	11,600
Total		XX	456,000	XX	470,000	XX	493,000
Kansas:							
Cement:							
Masonry		31	2,650	24	2,240 e/	25	2,330 e/
Portland		1,730	109,000	1,730	120,000 e/	1,760	124,000 e/

See footnotes at end of table.

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TABLE 5--Continued
NONFUEL RAW MINERAL PRODUCTION IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Kansas--Continued:							
Clays:							
Common		573	2,390	548	2,250	376	1,270
Fuller's earth		48	W	64	W	W	W
Gemstones		NA	W	NA	621	NA	1,000
Helium:							
Crude	million cubic meters	30	26,600	W	W	W	W
Grade-A	do.	53	105,000	53	104,000	54	108,000
Salt		2,770	113,000	2,950	118,000	3,100	121,000
Sand and gravel, construction		11,100	29,400	11,500	31,300	10,800	30,100
Stone:							
Crushed		20,400	95,800	22,100	110,000	23,600	118,000
Dimension 5/	metric tons	19,800	1,810	21,400	2,100	21,500	2,110
Combined value of gypsum (crude), pumice and pumicite, sand and gravel (industrial), stone (dimension sandstone), and values indicated by symbol W		XX	12,200	XX	40,600	XX	39,300
Total		XX	498,000	XX	530,000	XX	547,000
Kentucky:							
Clays:							
Ball		117	W	70	W	82	6,070
Common		786	3,430	823	3,680	739	3,790
Gemstones		NA	W	NA	5,910	NA	4,580
Sand and gravel, construction		8,710	31,700	7,310	25,600	7,890	28,300
Stone, crushed 5/		54,700	230,000	58,500	243,000	64,000	272,000
Combined value of cement, lime, stone [crushed (1995), crushed sandstone (1996-97)], and values indicated by symbol W		XX	167,000	XX	164,000	XX	161,000
Total		XX	432,000	XX	442,000	XX	476,000
Louisiana:							
Clays, common		384	548	382	548	481	887
Gemstones		NA	175	NA	136	NA	667
Salt		14,700	177,000	15,500	175,000	15,600	171,000
Sand and gravel:							
Construction		11,300	50,200	11,500	53,200	10,700	50,700
Industrial		572	10,500	706	12,100	566	10,900
Stone, crushed 5/		2,540	26,700	2,290	23,900	1,600	17,000
Combined value of gypsum (crude), lime, stone [crushed miscellaneous (1996-97), crushed shell and miscellaneous (1995)], sulfur (Frasch)		XX	169,000	XX	128,000	XX	128,000
Total		XX	434,000	XX	393,000	XX	379,000
Maine:							
Gemstones		NA	305	NA	223	NA	227
Peat		15	845	18	960	15	1,000
Sand and gravel, construction		6,420	26,900	6,440	27,500	10,000	43,800
Stone, crushed		3,110	16,100	2,760	14,800	3,100	17,200
Combined value of cement, clays (common), stone (dimension granite)		XX	23,500	XX	25,000	XX	26,000
Total		XX	67,600	XX	68,600	XX	88,200
Maryland:							
Cement, portland		1,670	101,000	1,610	99,400 e/	1,640	103,000 e/
Clays, common		278	943	304	874	293	920
Gemstones		NA	1	NA	1	NA	1
Sand and gravel, construction		9,700	61,700	9,700	61,400	11,200	72,700
Stone:							
Crushed		24,200	158,000	22,400 5/	142,000 5/	25,000 5/	195,000 5/
Dimension	metric tons	20,700	2,260	19,800	2,210	19,900	2,220
Combined value of other industrial minerals		XX	(6/)	XX	26,000	XX	26,400
Total		XX	324,000 7/	XX	332,000	XX	401,000

See footnotes at end of table.

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TABLE 5--Continued
NONFUEL RAW MINERAL PRODUCTION IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Massachusetts:						
Clays, common	31	W	W	W	W	W
Gemstones	NA	W	NA	1	NA	1
Sand and gravel, construction	11,700	67,500	14,200	82,500	15,200	90,100
Stone:						
Crushed	11,100	97,400	11,800 5/	91,600 5/	12,500 5/	97,000 5/
Dimension metric tons	77,600	14,600	79,600	15,000	80,000	15,100
Combined value of lime, peat, sand and gravel [industrial (1996-97)], stone [crushed miscellaneous (1996-97)], and values indicated by symbol W	XX	10,700	XX	11,100	XX	11,300
Total	XX	190,000	XX	200,000	XX	213,000
Michigan:						
Cement:						
Masonry	229	16,700	232	20,400 e/	237	21,200 e/
Portland	5,400	361,000	5,390	397,000 e/	5,500	413,000 e/
Clays, common	623	3,430	652	3,410	698	8,330
Gemstones	NA	2	NA	1	NA	1
Gypsum, crude	1,510	14,900	1,590	14,400	1,540	11,000
Iron ore, usable	13,500	W	W	W	W	W
Lime	653	34,600	584	30,300	590	30,700
Peat	173	5,510	168	4,650	167	4,090
Sand and gravel:						
Construction	53,500	178,000	53,800	197,000	59,300	222,000
Industrial	2,940	30,600	2,680	29,400	2,720	27,700
Stone, crushed	37,500	127,000	38,600 5/	144,000 5/	41,000 5/	160,000 5/
Combined values of bromine, copper (1995), iron oxide pigments (crude), magnesium compounds, potash, salt, silver (1995), stone [crushed granite and miscellaneous (1996-97), dimension dolomite and sandstone], and values indicated by symbol W	XX	750,000	XX	695,000	XX	664,000
Total	XX	1,520,000	XX	1,540,000	XX	1,560,000
Minnesota:						
Clays:						
Common	27	W	11	W	W	W
Kaolin	21	W	–	–	–	–
Gemstones	NA	26	NA	148	NA	677
Iron ore, usable	47,000	1,330,000	46,700	1,330,000	46,900	1,330,000
Peat	24	2,070	20	1,540	37	2,610
Sand and gravel, construction	31,900	99,400	31,800	107,000	46,800	161,000
Stone:						
Crushed	11,300 5/	47,400 5/	12,100	59,000	12,000	60,000
Dimension metric tons	26,900	11,100	25,400	10,700	25,600	10,800
Combined value of lime, sand and gravel (industrial), stone [crushed quartzite and traprock (1995)], and values indicated by symbol W	XX	40,400	XX	35,100	XX	34,900
Total	XX	1,530,000	XX	1,540,000	XX	1,600,000
Mississippi:						
Clays:						
Ball	73	4,540	73	4,540	73	4,540
Bentonite	164	6,510	145	4,480	156	4,630
Common	616	6,080	534	3,610	566	3,730
Fuller's earth	378	26,900	379	27,800	332	25,200
Gemstones	NA	1	NA	1	NA	1
Sand and gravel, construction	11,800	53,000	13,400	60,600	12,100	56,300
Stone, crushed 5/	1,990	8,010	2,180	9,300	1,900	8,300
Combined value of other industrial minerals	XX	25,500	XX	33,500	XX	34,800
Total	XX	131,000	XX	144,000	XX	137,000
Missouri:						
Cement, portland	4,360	270,000	4,530	293,000 e/	4,620	305,000 e/

See footnotes at end of table.

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TABLE 5--Continued
NONFUEL RAW MINERAL PRODUCTION IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Missouri--Continued:							
Clays:							
Ball		–	–	13	W	W	W
Common		972	4,810	849	3,250	984	3,370
Fire		359	5,480	223	3,220	217	3,150
Fuller's earth		283	W	283	W	283	W
Copper 3/		7	22,800	W	W	W	W
Gemstones		NA	58	NA	108	NA	650
Sand and gravel, construction		8,840	32,400	9,820	35,600	9,760	36,200
Stone, crushed		65,700 5/	305,000 5/	67,000	325,000	71,000	360,000
Combined value of barite, cement (masonry), iron ore (usable), iron oxide pigments (crude), lead, lime, sand and gravel (industrial), silver, stone [crushed granite (1995), dimension granite], zinc, and values indicated by symbol W		XX	495,000	XX	589,000	XX	610,000
Total		XX	1,140,000	XX	1,250,000	XX	1,320,000
Montana:							
Clays, common		33	90	34	W	34	W
Gemstones		NA	938	NA	1,840	NA	872
Gold 3/	kilograms	12,400	155,000	9,110	114,000	7,900	86,300
Iron ore, usable		5	60	–	–	W	W
Lead 3/	metric tons	8,350	7,790	7,970	8,580	8,000	8,320
Palladium	kilograms	5,260	22,000	6,100	25,500	8,340	46,700
Platinum	do.	1,590	20,800	1,840	23,500	2,500	31,700
Sand and gravel, construction		8,870	34,900	9,260	35,800	9,200	36,500
Silver 3/	metric tons	77	12,700	W	W	W	W
Stone, crushed		2,370 5/	9,920 5/	2,000	8,580	1,900	8,600
Zinc 3/	metric tons	22,700	27,900	19,400	21,900	22,300	39,800
Combined value of cement, clays (bentonite, fire), copper, garnet [industrial (1996-97)], lime, molybdenum, peat, sand and gravel (industrial), stone [crushed quartzite (1995), dimension miscellaneous], talc and pyrophyllite, and values indicated by symbol W		XX	283,000	XX	251,000	XX	239,000
Total		XX	574,000	XX	491,000	XX	498,000
Nebraska:							
Clays, common		232	1,130	277	1,140	189	601
Gemstones		NA	W	NA	3	NA	3
Lime		20	803	13	553	13	565
Sand and gravel, construction		13,700	47,100	12,900	44,300	14,300	50,500
Stone, crushed		6,590	41,800	6,370	39,800	7,000	45,000
Combined value of cement, gemstones, sand and gravel (industrial), and value indicated by symbol W		XX	55,500	XX	62,100	XX	64,500
Total		XX	146,000	XX	148,000	XX	161,000
Nevada:							
Clays:							
Bentonite		6	477	6	580	29	352
Kaolin		W	W	25	W	34	W
Copper 3/		6	19,800	W	W	W	W
Gemstones		NA	306	NA	234	NA	224
Gold 3/	kilograms	210,000	2,620,000	213,000	2,680,000	226,000	2,470,000
Sand and gravel, construction		22,500	110,000	22,400	113,000	18,200	93,700
Silver 3/	metric tons	693	115,000	605	101,000	676	94,600
Stone, crushed		2,410	21,400	3,080	25,200	2,900	24,000

See footnotes at end of table.

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TABLE 5--Continued
NONFUEL RAW MINERAL PRODUCTION IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Nevada--Continued:							
Combined value of barite, brucite, cement (portland), clays (fuller's earth), diatomite, gypsum (crude), lime, lithium minerals, magnesite, mercury, perlite (crude), salt, sand and gravel (industrial), and values indicated by symbol W		XX	180,000	XX	315,000	XX	350,000
Total		XX	3,060,000	XX	3,230,000	XX	3,030,000
New Hampshire:							
Clays, common		3	16	3	16	--	--
Gemstones		NA	9	NA	6	NA	6
Sand and gravel, construction		7,190	34,300	7,620	36,500	8,690	42,700
Stone:							
Crushed 5/		2,150	9,150	1,430	8,650	1,800	11,000
Dimension	metric tons	23,000	6,290	29,000	6,500	29,200	6,540
Total 7/		XX	49,800	XX	51,700	XX	60,200
New Jersey:							
Clays, common		82	135	74	125	W	W
Gemstones		NA	1	NA	1	NA	1
Sand and gravel:							
Construction		14,000	80,300	13,200	70,400	18,000	98,500
Industrial		1,760	31,000	1,680	30,300	1,720	30,500
Stone, crushed		21,000	132,000	21,400	145,000	23,800	163,000
Combined value of other industrial minerals and value indicated by symbol W		XX	(6/)	XX	(6/)	XX	4,040
Total		XX	243,000 7/	XX	246,000 7/	XX	296,000
New Mexico:							
Clays, common		127	274	32	165	41	129
Copper 3/		250	764,000	256	614,000	W	W
Gemstones		NA	22	NA	54	NA	54
Potash		2,330	209,000	2,430	225,000	2,450	240,000
Pumice and pumicite	metric tons	W	W	102,000	527	W	W
Sand and gravel, construction		10,400	50,700	9,880	48,500	9,070	45,600
Silver 3/	metric tons	20	3,300	W	W	W	W
Stone, crushed		3,660	18,800	3,480 5/	18,800 5/	2,700 5/	15,000 5/
Combined value of cement (portland), clays (fire), gold, gypsum (crude), iron ore (usable), mica (crude), molybdenum, perlite (crude), salt, stone [crushed quartzite and traprock (1996-97), dimension granite and marble], and values indicated by symbol W		XX	83,900	XX	85,100	XX	693,000
Total		XX	1,130,000	XX	992,000	XX	994,000
New York:							
Cement:							
Masonry		90	7,210	W	W	W	W
Portland		2,530	205,000	2,570	157,000 e/	2,620	163,000 e/
Clays, common		563	12,500	652	14,000	648	14,000
Gemstones		NA	W	NA	291	NA	337
Salt		4,480	185,000	4,420	203,000	3,610	158,000
Sand and gravel, construction		27,300	134,000	28,100	145,000	29,500	156,000
Stone:							
Crushed		39,500	204,000	43,600	233,000	47,000	271,000
Dimension	metric tons	32,800	8,440	34,400	8,120	34,600	8,160
Combined value of garnet (industrial), gypsum (crude), lead, peat, sand and gravel (industrial), silver, talc and pyrophyllite, wollastonite, zinc, and values indicated by symbol W		XX	130,000	XX	130,000	XX	133,000
Total		XX	886,000	XX	891,000	XX	904,000
North Carolina:							
Clays, common		2,430	12,500	2,400	12,400	2,550	23,700
Feldspar	metric tons	497,000	18,400	481,000	18,400	481,000	19,000

See footnotes at end of table.

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TABLE 5--Continued
NONFUEL RAW MINERAL PRODUCTION IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
North Carolina--Continued:							
Gemstones		NA	4,440	NA	693	NA	581
Mica, crude		74	3,690	62	4,900	56	5,050
Peat		19	340	15	311	11	225
Sand and gravel:							
Construction		10,100	50,100	10,000	50,500	12,800	66,000
Industrial		1,330	21,900	1,500	21,700	1,550	23,600
Stone:							
Crushed		57,300	384,000	57,200	394,000	66,000	460,000
Dimension	metric tons	41,100 5/	15,400 5/	37,300	14,300	37,500	14,300
Combined value of clays (kaolin), lithium minerals, olivine, phosphate rock, stone [dimension quartzite, sandstone, slate and miscellaneous (1995)], talc and pyrophyllite		XX	225,000	XX	172,000	XX	144,000
Total		XX	735,000	XX	690,000	XX	756,000
North Dakota:							
Clays, common		59	W	59	W	59	W
Gemstones		NA	W	NA	3	NA	3
Sand and gravel, construction		8,420	23,900	8,320	23,800	8,320	24,400
Combine value of peat, sand and gravel (industrial), and values indicated by symbol W		XX	7,300	XX	7,060	XX	7,160
Total		XX	31,200	XX	30,800	XX	31,600
Ohio:							
Cement, portland		1,050	72,700	W	W	W	W
Clays:							
Common		1,840	7,560	1,960	7,450	2,020	9,890
Fire		89	3,140	103	3,230	80	3,050
Gemstones		NA	3	NA	153	NA	W
Lime		1,920	117,000	2,020	107,000	2,040	109,000
Sand and gravel:							
Construction		45,300	196,000	46,600	215,000	47,000	222,000
Industrial		1,270	28,800	1,270	29,800	1,270	30,600
Stone:							
Crushed		60,900	265,000	63,600	291,000	69,000	324,000
Dimension	metric tons	17,900	1,670	19,800	2,060	19,900	2,070
Combined value of cement (masonry), gypsum (crude), peat, salt, silica stone (1996), and values indicated by symbol W		XX	200,000	XX	314,000	XX	284,000
Total		XX	891,000	XX	969,000	XX	984,000
Oklahoma:							
Cement:							
Masonry		95	7,250	101	8,850 e/	103	9,200 e/
Portland		1,740	110,000	1,750	118,000 e/	1,780	122,000 e/
Clays:							
Common		674	3,580	799	4,090	772	3,550
Fire		--	--	23	W	--	--
Gemstones		NA	W	NA	603	NA	995
Gypsum, crude		2,830	17,000	2,690	16,500	2,610	18,400
Iodine, crude	metric tons	1,210	12,500	1,270	14,600	1,330	24,000
Sand and gravel:							
Construction		7,800	25,100	7,910	27,700	9,120	32,700
Industrial		1,250	25,400	1,350	27,200	1,350	27,200
Stone:							
Crushed 5/		31,100	125,000	28,300	117,000	31,500	134,000
Dimension	metric tons	9,170 5/	2,350 5/	9,710	2,220	9,760	2,230

See footnotes at end of table.

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TABLE 5--Continued
NONFUEL RAW MINERAL PRODUCTION IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Oklahoma--Continued:							
Combined value of feldspar, helium [crude, Grade-A (1996-97)], lime, salt, stone [crushed shell and traprock, dimension quartzite and sandstone (1995)], tripoli (1995-96), and values indicated by symbol W		XX	28,700	XX	32,300	XX	36,000
Total		XX	357,000	XX	369,000	XX	411,000
Oregon:							
Clays:							
Bentonite		17	917	33	1,530	34	1,560
Common		222	354	213	154	213	154
Gemstones		NA	4,570	NA	6,730	NA	1,940
Nickel ore	metric tons	1,560	W	1,330	W	– 11/	–
Sand and gravel, construction		18,200	85,000	18,300	86,800	20,900	102,000
Stone, crushed		20,700	95,700	22,000	102,000	20,800	98,000
Talc and pyrophyllite	metric tons	W	W	64	84	W	W
Combined value of cement (portland), diatomite, emery (1995-96), lime, pumice and pumicite, zeolites, and values indicated by symbol W		XX	52,500	XX	67,100	XX	68,100
Total		XX	239,000	XX	265,000	XX	272,000
Pennsylvania:							
Cement:							
Masonry		267	21,200	274	28,000 e/	280	29,100 e/
Portland		5,610	355,000	5,670	418,000 e/	5,790	435,000 e/
Clays:							
Common		736	2,430	753	2,420	630	1,960
Kaolin		14	815	14	815	14	815
Gemstones		NA	1	NA	1	NA	1
Lime		1,640	107,000	1,530	105,000	1,550	106,000
Peat		11	294	4	166	8	181
Sand and gravel, construction		17,100	93,100	15,100	85,600	14,500	84,400
Stone:							
Crushed		80,900	492,000	87,400	518,000	93,000	568,000
Dimension	metric tons	57,600	12,300	54,300	11,800	54,600	11,800
Total 7/		XX	1,080,000	XX	1,170,000	XX	1,240,000
Rhode Island:							
Gemstones		NA	1	NA	1	NA	1
Sand and gravel, construction		2,790	21,500	1,990	13,300	1,910	13,100
Stone, crushed		1,250	9,140	1,440	9,680	1,400	9,500
Total 7/		XX	30,700	XX	23,000	XX	22,600
South Carolina:							
Cement:							
Masonry		W	W	286	27,100 e/	292	28,200 e/
Portland		2,210	156,000	2,370	186,000 e/	2,420	193,000 e/
Clays:							
Common		1,220	4,910	1,260	4,860	1,350	5,550
Fire		24	W	24	W	–	–
Kaolin		373	16,800	387	18,100	306	20,600
Gemstones		NA	W	NA	16	NA	16
Peat		W	W	–	–	3	10
Sand and gravel:							
Construction		8,880	29,000	8,780	29,000	9,000	30,500
Industrial		839	20,500	761	19,500	799	19,600
Stone, crushed		22,000	132,000	23,800	146,000	24,600	155,000
Combined value of gold, manganiferous ore (1995), mica (crude), silver, stone (dimension granite), vermiculite, and values indicated by symbol W		XX	88,700	XX	62,700	XX	54,300
Total		XX	447,000	XX	493,000	XX	507,000

See footnotes at end of table.

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TABLE 5--Continued
NONFUEL RAW MINERAL PRODUCTION IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
South Dakota:							
Clay, common		136	W	147	W	147	W
Gemstones		NA	173	NA	98	NA	93
Gold 3/	kilograms	17,100	214,000	W	W	W	W
Gypsum, crude		--	--	W	W	44	312
Sand and gravel, construction		8,730	26,200	8,750	27,700	8,940	29,000
Silver 3/	metric tons	4	668	5	816	5	714
Stone, crushed		5,420 5/	25,700 5/	5,640	28,700	7,000	36,000
Combined value of cement, feldspar, iron ore (usable), lime, mica (crude), stone [crushed granite and miscellaneous (1995), dimension granite], and values indicated by symbol W		XX	65,300	XX	300,000	XX	273,000
Total		XX	332,000	XX	357,000	XX	339,000
Tennessee:							
Clays:							
Ball		663	29,000	679	29,000	695	32,500
Kaolin		1	W	32	W	--	--
Gemstones		NA	16,900	NA	12,900	NA	9,740
Sand and gravel:							
Construction		8,020	36,700	8,380	35,300	9,790	42,300
Industrial		918	14,700	747	13,900	721	13,400
Stone, crushed		52,600	286,000	55,100	305,000	60,000	336,000
Combined value of barite, cement, clays (fuller's earth), copper (1995-96), lead, lime, silver (1995-96), stone (dimension marble), zinc, and values indicated by symbol W		XX	282,000	XX	266,000	XX	352,000
Total		XX	665,000	XX	662,000	XX	786,000
Texas:							
Cement:							
Masonry		202	17,600	216	20,300 e/	220	21,100 e/
Portland		8,090	499,000	8,240	532,000 e/	8,400	553,000 e/
Clays:							
Ball		101	2,800	101	W	W	W
Common		2,320	15,500	2,290	15,000	2,240	18,100
Kaolin		36	7,700	28	W	W	W
Gemstones		NA	353	NA	511	NA	932
Gypsum, crude		1,880	16,200	2,240	12,100	2,150	15,400
Helium:							
Crude	million cubic meters	5	4,730	W	W	W	W
Grade-A	do.	W	W	W	W	14	27,000
Lime		1,370	85,800	1,360	86,300	1,370	87,100
Salt		9,110	85,000	9,700	88,900	9,700	87,700
Sand and gravel:							
Construction		61,100	271,000	61,300	278,000	53,700	249,000
Industrial		1,600	40,300	1,420	38,200	1,590	47,500
Stone:							
Crushed		81,100	310,000	86,500	341,000	81,200	325,000
Dimension	metric tons	54,000	13,300	86,600	21,100	87,000	21,200
Talc and pyrophyllite	do.	294,000	5,840	225,000	5,100	249,000	5,800
Combined value of clays [bentonite (1995), fuller's earth], magnesium compounds, magnesium metal, sodium sulfate (natural), sulfur (Frasch), and values indicated by symbol W		XX	301,000	XX	293,000	XX	240,000
Total		XX	1,680,000	XX	1,730,000	XX	1,700,000
Utah:							
Beryllium concentrates	metric tons	5,040	6	5,260	6	5,300	6
Clays:							
Bentonite		38	W	W	1,400	45	1,080
Common		386	4,280	298	4,510	401	4,220
Fuller's earth		--	--	W	32	--	--

See footnotes at end of table.

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TABLE 5--Continued
NONFUEL RAW MINERAL PRODUCTION IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Utah--Continued:						
Gemstones	NA	939	NA	1,150	NA	221
Iron ore, usable	144	1,700	–	–	–	–
Salt	2,160	54,800	1,720	70,400	1,800	67,100
Sand and gravel, construction	23,800	80,200	24,700	80,500	33,000	110,000
Stone, crushed	4,140	14,800	4,380	19,100	6,000	27,000
Combined value of cement, copper, gold, gypsum (crude), helium (Grade-A), lime, magnesium compounds, magnesium metal, mercury, molybdenum, phosphate rock, potash, silver, stone dimension quartzite and sandstone), and value indicated by symbol W	XX	1,700,000	XX	1,560,000	XX	1,550,000
Total	XX	1,850,000	XX	1,730,000	XX	1,760,000
Vermont:						
Gemstones	NA	1	NA	1	NA	1
Sand and gravel, construction	3,220	11,000	3,870	15,200	3,510	14,100
Stone:						
Crushed	4,420	20,700	4,560	22,800	5,100	26,000
Dimension metric tons	100,000	28,700	99,600	27,900	100,000	28,100
Total 7/	XX	60,400	XX	66,000	XX	68,200
Virginia:						
Clays:						
Common	844	3,200	883	3,220	862	3,340
Fuller's earth	46	W	46	W	48	W
Gemstones	NA	W	NA	11	NA	11
Lime	731	41,900	766	45,700	774	46,200
Sand and gravel, construction	9,710	42,300	9,780	45,800	11,300	54,200
Stone, crushed	55,400	326,000	59,700	351,000	66,000	392,000
Combine value of cement, feldspar, gypsum (crude), iron oxide pigments (crude), kyanite, sand and gravel (industrial), stone [dimension dolomite, slate, and traprock (1995), dimension dolomite, granite, slate, and traprock (1996-97)], talc and pyrophyllite (1996-97), vermiculite, and values indicated by symbol W	XX	101,000	XX	103,000	XX	104,000
Total	XX	515,000	XX	549,000	XX	600,000
Washington:						
Cement, portland	W	W	1,160	78,900 e/	1,180	82,100 e/
Clays, common	220	1,040	218	1,070	207	956
Gemstones	NA	53	NA	36	NA	34
Gypsum, crude	–	–	W	W	9	63
Peat metric tons	2	87	W	W	W	W
Sand and gravel, construction	37,700	155,000	37,900	162,000	38,900	170,000
Stone, crushed	15,800 5/	76,800 5/	15,400	81,400	17,000	90,100
Combined value of cement (masonry) , diatomite, gold, lime, magnesium metal, olivine, sand and gravel (industrial), stone [crushed dolomite, limestone, and marble (1995), dimension miscellaneous], and values indicated by symbol W	XX	350,000	XX	212,000	XX	179,000
Total	XX	582,000	XX	535,000	XX	522,000
West Virginia:						
Clays, common	184	365	199	369	169	338
Gemstones	NA	1	NA	1	NA	1
Sand and gravel, construction	1,800	7,650	1,730	7,710	1,830	8,330
Stone, crushed 5/	11,800	75,000	12,700	78,400	12,600	79,000
Combined value of cement, lime, peat, salt, sand and gravel (industrial), stone (crushed dolomite, dimension sandstone)	XX	97,700	XX	98,600	XX	102,000
Total	XX	181,000	XX	185,000	XX	190,000

See footnotes at end of table.

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TABLE 5--Continued
NONFUEL RAW MINERAL PRODUCTION IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Wisconsin:						
Gemstones	NA	65	NA	505	NA	927
Lime	568	33,900	551	32,000	557	32,400
Sand and gravel:						
Construction	32,200	102,000	32,600	105,000	33,500	111,000
Industrial	1,670	33,300	1,660	32,300	1,730	34,400
Stone:						
Crushed	26,000	108,000	26,000	113,000	29,000	128,000
Dimension metric tons	128,000	14,500	143,000	16,600	144,000	16,700
Combined value of copper, gold, peat, silica stone (1995-96), silver	XX	124,000	XX	96,800	XX	65,200
Total	XX	416,000	XX	396,000	XX	389,000
Wyoming:						
Clays:						
Bentonite	2,940	89,900	3,030	98,400	3,010	97,900
Common	30	W	30	W	30	W
Gemstones	NA	11	NA	11	NA	12
Sand and gravel, construction	3,860	17,500	3,420	14,700	3,220	14,100
Stone, crushed	4,670	27,500	5,180	30,000	4,900	29,000
Combined value of cement (portland), gypsum (crude), (crude), helium (Grade-A), lime, soda ash, and values indicated by symbol W	XX	838,000	XX	935,000	XX	855,000
Total	XX	973,000	XX	1,080,000	XX	996,000
Undistributed:						
Alaska (1995), Connecticut (1996-97), Delaware, Hawaii, Maryland (1995), New Hampshire, New Jersey (1995-96), Pennsylvania, Rhode Island, Vermont	XX	123,000	XX	30,200	XX	29,800

e/ Estimated. p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data, value included with "Combined value." XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Recoverable content of ores, etc.

4/ Data collected by State.

5/ Excludes certain stones; kind and value included with "Combined value."

6/ Value excluded to avoid disclosing company proprietary data.

7/ Partial total, excludes values which must be concealed to avoid disclosing company proprietary data. Withheld values included with "Undistributed."

8/ Grindstones, pulpstones, and sharpening stones; excludes mill liners and grinding pebbles.

9/ Weight reported as B_2O_3 and is not comparable to prior years.

10/ Less than 1/2 unit.

11/ Quantity of local ore fed to smelter after rejection of lower grade material. The Nickel Mountain Mine reportedly was idle all of 1997 because of disappointing prices for nickel ore. However, the smelter operated at full capacity. The smelter normally uses lateritic ore imported from New Caledonia in addition to lateritic ore mined on Nickel Mountain. In a normal year, the value reflects the grade of the local ore, the projected average unit customs value for competing ore imported from New Caledonia, and the projected average reported by the London Metal Exchange ($6,931 per metric ton nickel in 1997).

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TABLE 6
NONFUEL RAW MINERAL PRODUCTION IN THE COMMONWEALTH OF PUERTO RICO AND ISLANDS ADMINISTERED BY THE UNITED STATES 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Puerto Rico:						
Cement, portland metric tons	1,410	W	1,550	W	1,580	W
Lime	23	2,970	38	5,050	38	5,080
Salt	–	–	45	1,500	45	1,500
Stone, crushed	15,300	107,000	13,200	52,500	13,200	52,500
Combined value of clays (common), sand and gravel (industrial), stone (dimension marble), and values indicated by symbol W	XX	146,000	XX	153,000	XX	158,000
Total	XX	256,000	XX	212,000	XX	217,000
Administered Islands:						
American Samoa: Stone, crushed	(3/)	(3/)	–	–	–	–
Guam: Stone, crushed	2,060	17,400	1,660	13,800	1,600	13,800
Total 4/	XX	17,400	XX	13,800	XX	13,800

p/ Preliminary. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Withheld to avoid disclosing company proprietary data.

4/ Total does not include values of items withheld.

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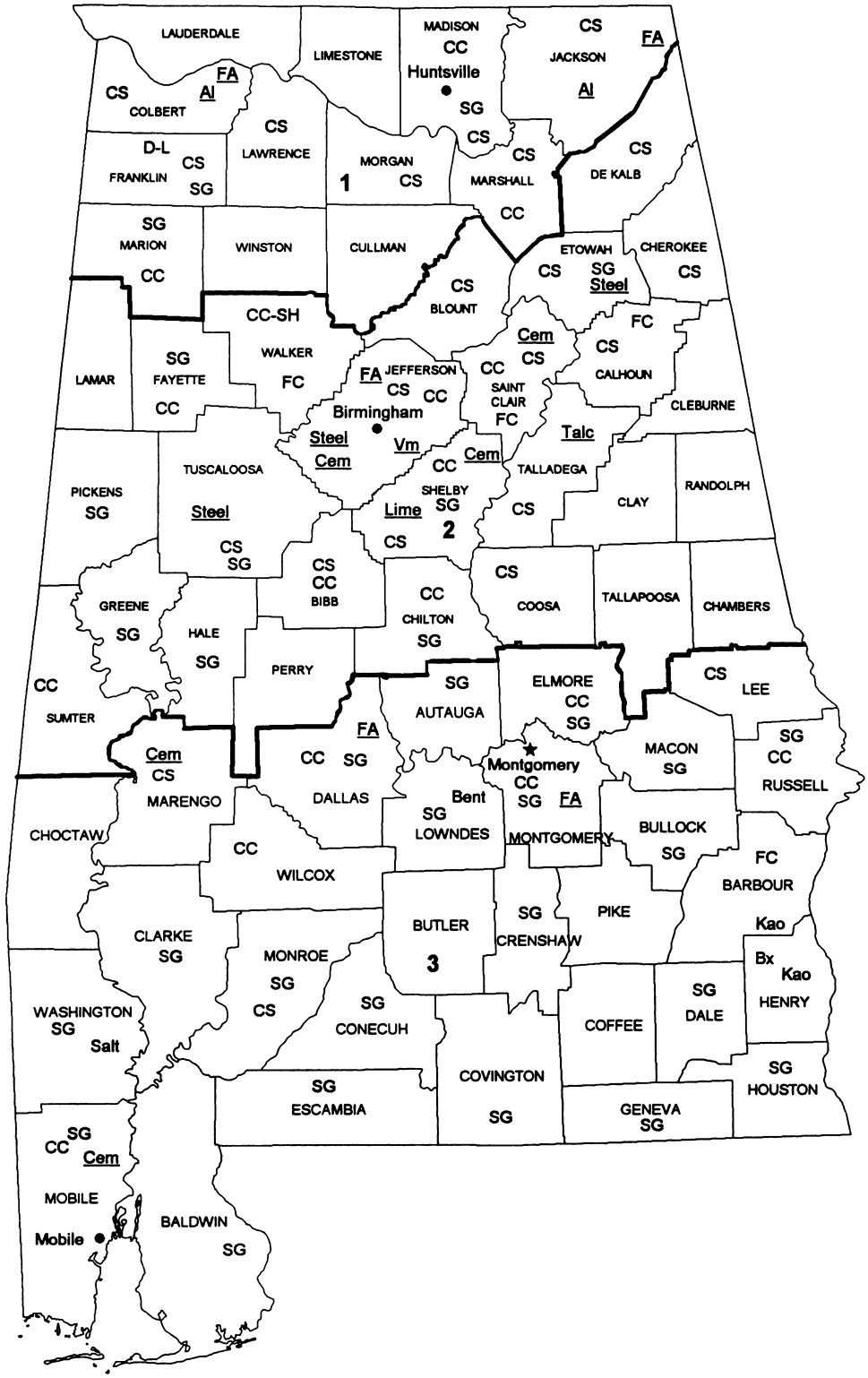
ALABAMA



Source: Geological Survey of Alabama/U.S. Geological Survey

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THE MINERAL INDUSTRY OF ALABAMA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Geological Survey of Alabama for collecting information on all nonfuel minerals.

In 1997, Alabama ranked 18th among the 50 States in nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS); the State was 17th in 1996. The estimated value for 1997 was $805 million, an increase of more than 3% from that of 1996. This followed a 10% increase from 1995 to 1996 (based on final 1996 data). The State accounted for 2% of the U.S. total nonfuel mineral production value.

The top four nonfuel mineral commodities produced in Alabama in 1997 were, in descending order of value, portland cement, crushed stone, lime, and construction sand and gravel; these accounted for 89% of the State's total nonfuel mineral production value. The combined value of crushed stone and portland cement represented 67% of the total. Of the increase in value 48% resulted from the $13 million increase in portland cement (*table 1*). All other nonfuel minerals increased in value, except for gemstones, which had a minimal decrease, and bentonite and industrial sand and gravel, which were unchanged.

In 1996, increases in nonfuel mineral commodity values were larger than those of 1997. The value of portland cement increased by $41 million; crushed stone, by $24 million; construction sand and gravel, by $12 million; and lime, by $11 million.

Nonfuel mineral production in Alabama consisted entirely of industrial minerals; no metals were mined in the State. Compared with USGS estimates of the quantities produced in the other 49 States in 1997, Alabama rose to first from second in the production of common clays; to second from third in kaolin; to third from fourth in fire clays: and to seventh from eighth in salt. The State remained second in bentonite, third in masonry cement, fourth in lime, and sixth in portland cement. Additionally, Alabama's stone quarries and sand pits produced substantial quantities of crushed stone and construction and industrial sand and gravel. All metal production in the State, especially that of raw steel, was the result of processing materials acquired from other domestic and foreign sources. Production of bauxite in Alabama has not been reported to the USGS since 1995. Bauxite that is mined in the State is a natural mixture of bauxite and bauxitic clay that has a very low iron oxide content and is primarily used to make refractory (high temperature resistant) products, rather than to produce primary aluminum. These materials have, of late, been reported to the USGS as kaolin.

The following narrative information was provided by the Geological Survey of Alabama[2] (GSA). In 1997, 162 companies or operations were involved in the mining and production of industrial mineral resources. Included in this number were 38 limestone-dolomite crushed stone operations, 6 lime plants, and a number of granite, sandstone, and quartzite crushed stone operations. Two marble operations produced micronized calcium carbonate. Other operations included 18 clay (common clay, bentonite, fuller's earth, kaolin, and fire clay) and 11 bauxitic clay, as well as chalk, building stone, and recovered sulfur.

During 1997, 91 sand and gravel pits were in operation. The Montgomery district, located in the Coastal Plain region of south-central Alabama (see district 3 on the Alabama State map), is the largest sand and gravel producing area in the State. Sand and gravel resources occur principally in Quaternary alluvium and terrace deposits of the Alabama, Coosa, and Tallapoosa Rivers bordering Montgomery, Autauga, Lowndes, Elmore, and Macon Counties. Since 1970, the Montgomery district has produced about 3.2 million metric tons per year of sand and gravel, or about 40% of the entire production of the State; large-scale production began in the early 1920's.

Mineral exploration in Alabama continued to focus on industrial minerals with several large expansions and new operations. The United States Gypsum Co. announced plans to build a $110 million wallboard plant in Bridgeport, Jackson County. This operation will utilize synthetic gypsum produced as a byproduct of flue gas desulfurization. The Olin Corp. initiated a $100 million expansion of its chlorine and chemical plant at McIntosh, Washington County; this operation utilizes solution mining of a shallow salt dome. Monarch Tile Inc. announced a $15 million expansion of its floor tile plant in Florence, Lauderdale County. Blue Circle Cement Co. installed a new 1,000-ton-per-day preheater rotary kiln, modernized the hydration system, and made improvements to the quarry, storage, and load-out facilities at its Roberta lime plant in Shelby County. Also in Shelby County, Chemical Lime Co. completed construction of a new 1,200-ton-per-day lime plant at its O'Neal limestone quarry.

Other expanding mineral industries include refractory clay production in the Eufaula bauxite district and artificial zeolite production in southern Alabama. Expansions and new operations also were reported in limestone and marble quarries for crushed stone and calcium carbonate.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Lewis S. Dean, Geologist, authored the text of State minerals information provided by the Geological Survey of Alabama.

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The GSA published its annual summary, "The Minerals Industry of Alabama—1997," which provides details of the occurrence, mining history, and general economics of specific mineral resources in Alabama. More information on geology, hydrology, and environmental considerations related to these resources is available from the GSA.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN ALABAMA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement:						
Masonry	306	30,700	309	32,000 e/	315	33,300 e/
Portland	4,090	285,000	4,330	326,000 e/	4,410	339,000 e/
Clays:						
Bentonite	154	4,700	166	5,060	166	5,060
Common	2,080	18,600	2,290	17,100	2,670	20,500
Fire	80	3,120	52	2,800	53	2,840
Kaolin	373	7,220	254	W	471	W
Gemstones	NA	3,000 r/	NA	2,000	NA	1,980
Lime	1,730	105,000	1,860	116,000	1,880	117,000
Sand and gravel:						
Construction	11,900	49,400	13,800	60,600	13,600	61,300
Industrial	479	5,940	799	8,380	780	8,380
Stone, crushed	33,600	174,000	38,900	198,000	38,000	200,000
Combined value of bauxite (1995), iron oxide pigment (crude, 1997), salt, stone (dimension limestone and sandstone), and values indicated by symbol W	XX	6,810	XX	9,930	XX	15,200
Total	XX	693,000 r/	XX	778,000	XX	805,000

e/ Estimated. p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
ALABAMA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quanity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quanity (thousand metric tons)	Value (thousands)	Unit value
Limestone 2/	40	29,500	$151,000	$5.11	43	34,800	$176,000	$5.06
Dolomite	3	W	W	5.14	3	W	W	5.34
Marble	1	816	W	W	1	W	W	5.56
Granite	6	W	W	5.58	5	W	W	5.02
Slate	2	W	W	4.27	2	W	W	3.46
Total	XX	33,600	174,000	5.19	XX	38,900	198,000	5.09

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes limestone-dolomite reported with no distinction between the two.

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TABLE 3
ALABAMA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	W	W	$6.51
Riprap and jetty stone	337	$1,690	5.01
Filter stone	15	63	4.20
Other coarse aggregate	29	96	3.31
Coarse aggregate, graded:			
Concrete aggregate, coarse	3,110	14,400	4.63
Bituminous aggregate, coarse	4,390	21,900	4.98
Bituminous surface-treatment aggregate	332	1,660	4.99
Railroad ballast	114	527	4.62
Fine aggregate (-3/8 inch):			
Stone sand, concrete	375	1,680	4.48
Stone sand, bituminous mix or seal	1,790	8,570	4.80
Screening, undesignated	212	1,010	4.76
Other fine aggregates	2	16	8.00
Coarse and fine aggregates:			
Graded road base or subbase	3,140	14,300	4.56
Unpaved road surfacing	393	1,930	4.90
Terrazzo and exposed aggregate	W	W	5.56
Crusher run or fill or waste	3,210	16,000	5.00
Other construction materials	396	1,710	4.32
Agricultural:			
Agricultural limestone	126	662	5.25
Poultry grit and mineral food	57	596	10.46
Other agricultural uses	7	73	10.43
Chemical and metallurgical:			
Cement manufacture	(3/)	(3/)	2.87
Dead-burned dolomite manufacture	320	1,510	4.73
Flux stone	117	428	3.66
Special:			
Mine dusting or acid water treatment	(3/)	(3/)	27.56
Other fillers or extenders	(3/)	(3/)	20.43
Unspecified: 4/			
Actual	13,100	72,700	5.54
Estimated	5,190	28,300	5.46
Total	38,900	198,000	5.09

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Includes dolomite, granite, limestone, limestone-dolomite, marble, and slate.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Withheld to avoid disclosing company proprietary data; included in "Total."
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
ALABAMA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996,
BY USE AND DISTRICT 1/ 2/

Use	District 1 Quantity (thousand metric tons)	District 1 Value (thousand thousands)	District 2 Quanity (thousand metric tons)	District 2 Value (thousand thousands)
Construction aggregates:				
Coarse aggregate (+1 1/2 inch) 3/	W	W	W	W
Coarse aggregate, graded 4/	W	W	W	W
Fine aggregate (-3/8 inch) 5/	W	W	W	W
Coarse and fine aggregate 6/	W	W	W	W
Other construction materials	9,510	45,400	8,410	41,100
Agricultural 7/	(8/)	(8/)	(8/)	(8/)
Chemical and metallurgical 9/	--	--	(8/)	(8/)
Special 10/	--	--	(8/)	(8/)
Unspecified 11/				
Actual	159	673	13,000	72,000
Estimated	(8/)	(8/)	4,830	26,500
Total	10,100	48,400	28,800	150,000

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Production reported in District 3 was included with "District 2" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, and railroad ballast.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing and crusher run (select material or fill).
7/ Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes cement manufacture, dead-burned dolomite manufacture, and flux stone.
10/ Includes mine dusting or acid water treatment and other fillers or extenders.
11/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
ALABAMA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 2/	2,140	$8,220	$3.85
Concrete products (blocks, bricks, pipe, decorative, etc.)	134	1,530	11.43
Asphaltic concrete aggregates and other bituminous mixtures	329	1,010	3.06
Road base and coverings 3/	383	1,990	5.20
Fill	119	174	1.46
Other miscellaneous uses	415	1,670	4.02
Unspecified: 4/			
Actual	4,470	21,200	4.74
Estimated	5,780	24,800	4.29
Total or average	13,800	60,600	4.40

1/ Data are rounded to three significant digits, except value per ton; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (lime).
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
ALABAMA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars

Use	District 2		District 3	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	132	808	2,140	8,940
Asphaltic concrete aggregates and road base materials 4/	65	185	767	2,990
Other miscellaneous uses	410	1,630	5	34
Unspecified: 5/				
Actual	1,320	5,280	3,150	15,900
Estimated	1,220	5,060	4,560	19,700
Total	3,150	13,000	10,600	47,600

1/ Production reported in "District 1" was included with "District 2" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Includes fill and road and other stabilization (lime).
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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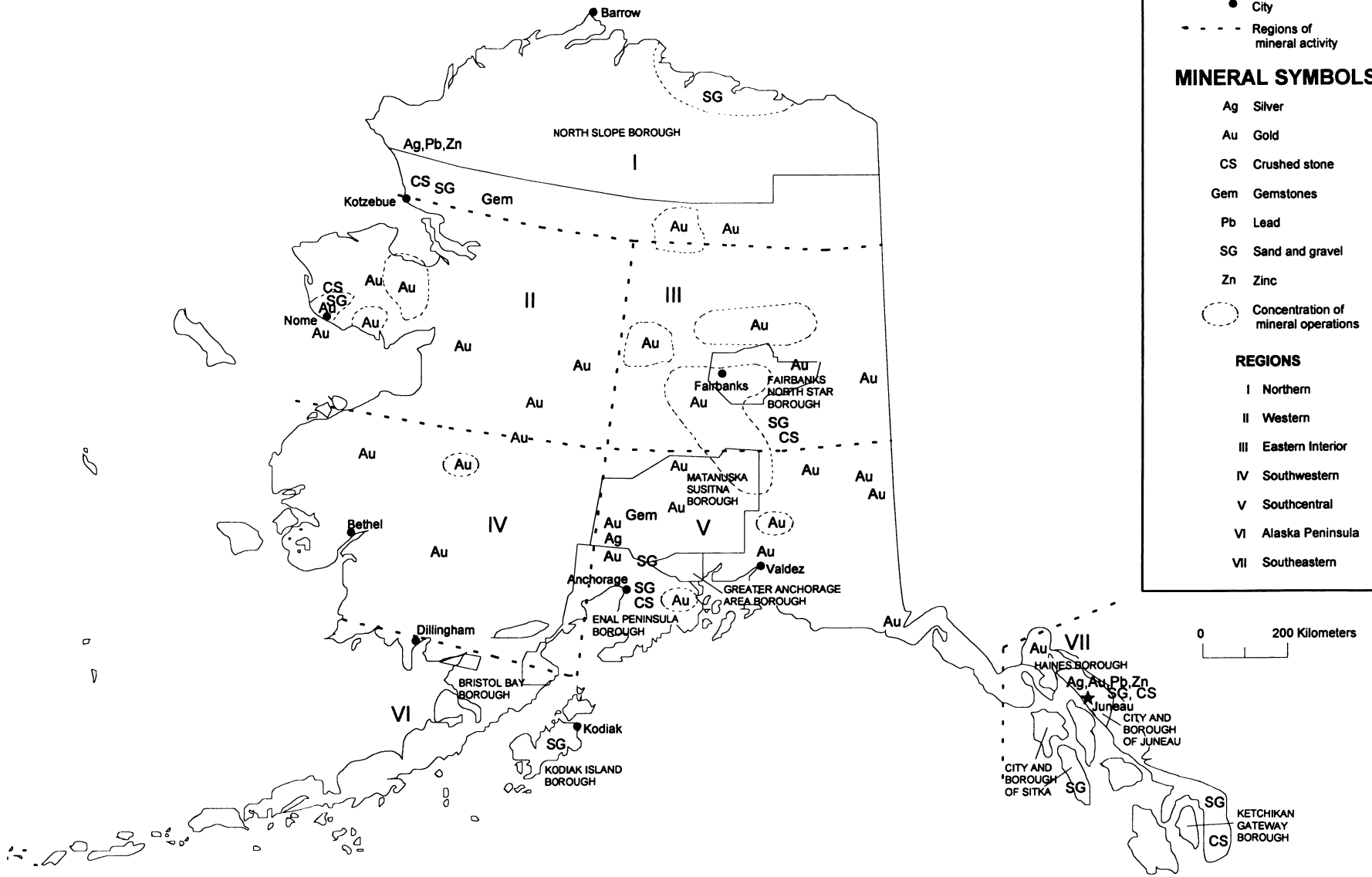
ALASKA



LEGEND

- State boundary
- Borough boundary
- ★ Capital
- ● City
- Regions of mineral activity

MINERAL SYMBOLS

Ag	Silver
Au	Gold
CS	Crushed stone
Gem	Gemstones
Pb	Lead
SG	Sand and gravel
Zn	Zinc
	Concentration of mineral operations

REGIONS

I	Northern
II	Western
III	Eastern Interior
IV	Southwestern
V	Southcentral
VI	Alaska Peninsula
VII	Southeastern

Source: Alaska Division of Geological and Geophysical Surveys/U.S. Geological Survey

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THE MINERAL INDUSTRY OF ALASKA

In 1997, Alaska climbed to 17th from 21st (1996) among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $942 million, a nearly 54% increase from that of 1996. This followed a 13.9% increase from 1995 to 1996 (based on final 1996 data). The total value for 1995, as given in table 1, is artificially low because some data were withheld to avoid disclosing company proprietary data. The State accounted for about 2.5% of the U.S. total nonfuel mineral production value.

Overall, metallic minerals accounted for more than 93% of the State's total production value. A large majority of this was from zinc, lead, and silver production at the Red Dog Mine in northwestern Alaska and gold from the newly commissioned Fort Knox Mine near Fairbanks in east central Alaska. In 1997, substantial increases in the production and values of gold, zinc, and silver (in descending order of increase) accounted for most of the State's rise in value *(table 1)*. Smaller yet significant increases also occurred in lead and construction sand and gravel; crushed stone also showed a small increase. Compared with that of 1995, the increased production values of lead, silver, and gold in 1996 more than compensated for decreases that occurred mostly in construction sand and gravel and crushed stone.

Based on USGS estimates of the quantities produced in the 50 States during 1997, Alaska remained first in zinc, second in lead, and one of the top three silver-producing States. The State climbed to fifth from eighth[2] of the 13 gold-producing States. Production of peat was not reported to the USGS, in part because of reporting difficulties associated with the seasonal, intermittent nature of peat mining in the State. The Alaska Department of Natural Resources' Division of Geological and Geophysical Surveys (DGGS) estimated peat production to be about 28,300 cubic meters for a value of more than $170,000.

The following narrative information was provided by the DGGS, much of the data based on DGGS surveys and estimates (Swainbank, 1997). Highlights for 1997 include new production at the Fort Knox gold mine and the Illinois Creek gold-silver mine near Galena; full production at the Greens Creek polymetallic mine near Juneau; increased production at the Red Dog zinc-lead mine near Kotzebue; and continued production at Nixon Fork. There was placer production by Alaska Gold Co. in Nome, Yellow Eagle Mining Inc. and Polar Mining Inc. in Fairbanks, as well as dozens of smaller mines. Development was reported at Red Dog, the Kensington gold mine near Juneau, and the Calder Bay limestone deposit on Prince of Wales Island.

Exploration highlights include continued success at gold prospects such as True North, Ester Dome and Golden Summit near Fairbanks; Donlin Creek and Golden Horn near Flat; and Pogo near Delta. Substantial exploration for base metal and polymetallic deposits was reported at Red Dog, throughout the eastern interior, at the Pebble Copper Prospect near Iliamna, and at the Niblack Mine on Prince of Wales Island.

Although investment in mining development was less in 1997 than in 1996, an increase in exploration expenditures and in the value of the minerals and materials produced resulted in a slight increase in the total value of the industry. Exploration expenditures in 1997 were $57.3 million ($44.6 million in 1996), development investment was $167 million ($394 million in 1996), and the value of production in 1997 was $902 million compared with $590 million in 1996. The net result is that the total value of the industry in 1997 was $1.13 billion versus $1.03 billion in 1996. There was a substantial increase in all types of hard rock mining employment in 1997, offset to some extent by a decline in placer mining and particularly in mine development work.

With the commissioning of the Fort Knox and Illinois Creek gold mines, and full production at the Greens Creek polymetallic mine, there was a surge in the amount of gold and silver produced in 1997, and increased production of lead and zinc. These factors, coupled with higher average prices for zinc than in 1996, led to a much higher value of base metals for 1997.

The Red Dog zinc-lead-silver mine owned by NANA Corp. and operated by Cominco Alaska Inc. produced 610,000 metric dry tons of 55.2% zinc concentrate and 113,000 dry tons of 56.1% lead concentrate from 1,930,000 tons of ore milled. Average grades of the mill-feed were 20.3% zinc, 5.2% lead and 98 grams per metric ton silver. Operating profit for 1997 was $102 million compared with $25 million in 1996.

Alaska Gold Co. continued with open-pit placer gold mining of the raised beaches north of Nome, while Novus Resources tested its suction-dredge methods offshore. About 40 miles south of Galena, the Illinois Creek lode gold-silver mine poured its first gold in June. Dakota Mining Corp. expects final tabulation of production for 1997 to be about 680 kilograms, to be about 2,500

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. Construction sand and gravel and crushed stone estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Gold figures in table 1, as reported to the USGS, possibly understate actual 1997 production and value. The canvassing of gold placer mineral production was discontinued by the U.S. Bureau of Mines (the Federal agency formerly responsible for U.S. nonfuel mineral production data collection) in 1994. Gold production and value in table 1 are preliminary numbers that are estimated by the USGS. Data collected by Alaska's State government indicate estimated production in 1997 to have been 17,970 kilograms at about $198.4 million. Final total gold production for Alaska, done in collaboration with the Alaska Department of Natural Resources' Division of Geological and Geophysical Surveys, is reflected in final 1995 and 1996 data in table 1.

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kilograms in 1998, and to average about 2,000 kilograms per year for the next 5 years.

At the Nixon Fork gold-copper skarn mine near McGrath, Consolidated Nevada Goldfields Inc. expects to produce about 1,200 kilograms of gold as well as copper concentrates.

With the commissioning of the Fort Knox gold mine about 24 kilometers northeast of Fairbanks, this region became the second most productive region of the State in 1997. Although the first official gold pour at the Fort Knox Mine was on December 20, 1996, the first commercial gold was produced in March 1997. Production through the end of December, including 1,421 kilograms of precommercial production prior to March 1, was 11,391 kilograms from 10,604,000 tons grading 1.2 grams per metric ton. The cash cost per ounce was $170, the total production cost was $342, and the average selling price for all operations worldwide was $360 per ounce.

There were several medium-sized placer gold mines operating in the Fairbanks area in 1997, including the Cripple Creek Venture between Yellow Eagle Mining and Exploration Orbite at Ester; Polar Mining's open-pit operation at Fox; and the Little Eldorado Group's underground operation on its namesake creek. Alaska Placer Development was actively mining the Livengood Bench about 130 kilometers north of Fairbanks, and there were about a dozen smaller operations in the Manley-Rampart area about 160 kilometers to the west of the city. Placer operations were also active in the Circle, Seventymile, Fortymile, and Bonnifield districts of central Alaska.

The Greens Creek Mine (Kennecott 70.3%, Hecla Mining 29.7%), expects to produce concentrates containing payable 36,000 tons of zinc, 18,000 tons of lead, 1,700 kilograms of gold, 342 tons of silver, and 900 tons of copper. The only other mines reporting production were two placer mines in the panhandle.

In 1997, the Illinois Creek gold-silver mine near Galena and the Fort Knox gold mine near Fairbanks became operational, and the Greens Creek Mine near Juneau had reached full productivity. Statewide exploration expenditures reported in 1997 were up 28% from the previous year.

During 1997 the DGGS released new geophysical surveys in the historic mining regions of Rampart, Chulitna, and Petersville-Collinsville. New surveys were contracted and flown during 1997 near Iron Creek in the Talkeetna Mountains north of Anchorage, and south of Ruby on the Yukon River. The Iron Creek survey results were released in January 1998 and the Ruby survey in February 1998. The Division also worked with the U.S. Bureau of Land Management to contract for airborne surveys near Wiseman in the Brooks Range and, together with municipal funds, near Wrangell in southeastern Alaska. The Wrangell surveys were released late in 1997 and the Wiseman survey is expected to be released early in 1998.

Reference Cited

Swainbank, R.C. and Clautice, K.H., *Alaska's Mineral Industry 1997: A Summary,* Information Circular 43, Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys, March 1998, 12 p.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN ALASKA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Gemstones		NA	10	NA	11	NA	10
Gold 3/ 4/	kilograms	4,410	56,000	5,020	61,000	16,300	175,000
Sand and gravel, construction		13,700	48,500	9,380	35,900	10,000	39,300
Silver 3/	metric tons	109	18,100	W	W	W	W
Stone, crushed 5/		2,430 r/	14,500 r/	2,600	16,500	2,600	17,000
Zinc 3/	metric tons	321,000	395,000	W	W	W	W
Combined values of copper (1996-97), lead, stone [crushed dolomite, granite, and limestone (1997), crushed dolomite and limestone (1995-96)], zinc, and values indicated by symbol W		XX	(6/)	XX	499,000	XX	711,000
Total		XX	532,000 r/ 7/	XX	613,000	XX	942,000

p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Recoverable content of ores, etc.

4/ Data collected by the State.

5/ Excludes certain stones; kind and value included with "Combined value" data. Figures for crushed stone in 1995 are current as of July 1998 and do not agree with those published in the 1997 Preliminary Statistical Summary.

6/ Value excluded to avoid disclosing company proprietary data.

7/ Partial total, excludes values that must be concealed to avoid disclosing company proprietary data.

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TABLE 2
ALASKA: CRUSHED STONE SOLD OR USED, BY KIND 1/ 2/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone-dolomite	(3/)	(3/)	(3/)	(3/)	(3/)	(3/)	(3/)	(3/)
Granite	1	24	$100	$4.17	(3/)	(3/)	(3/)	(3/)
Traprock	5	1,030	3,230	3.15	6	888	$3,300	$3.72
Slate	1	7	48	6.86	1	7	48	6.86
Miscellaneous stone	6	1,370 r/	11,100 r/	8.10 r/	6	1,710	13,200	7.72
Total	XX	2,430 r/	14,500 r/	5.97 r/	XX	2,600	16,500	6.35

r/ Revised. XX Not applicable.
1/ Data derived in part from the Alaska Division of Geological and Geophysical Surveys information.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes limestone-dolomite and granite from State total to avoid disclosing company proprietary data.

TABLE 3
ALASKA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/ 3/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse and fine aggregates:			
Graded road base or subbase	70	$572	$8.17
Unpaved road surfacing	22	171	7.77
Crusher run or fill or waste	19	194	10.21
Other construction materials 4/	122	757	6.20
Unspecified: 5/			
Actual	1,640	12,500	7.63
Estimated	726	2,290	3.15
Total	2,600	16,500	6.35

1/ Data derived in part from the Alaska Division of Geological and Geophysical Surveys information.
2/ Includes miscellaneous stone, slate, and traprock; excludes limestone-dolomite and granite from State total to avoid disclosing company proprietary data.
3/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
4/ Includes bituminous aggregate (coarse), concrete aggregate (coarse), filter stone, other coarse aggregate, other graded coarse aggregate, riprap and jetty stone, stone sand (concrete), and screening (undesignated).
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
ALASKA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	161	$1,320	$8.22
Concrete products (blocks, bricks, pipe, decorative, etc.)	18	85	4.72
Asphaltic concrete aggregates and road base materials	1,340	5,850	4.37
Snow and ice control	48	413	8.60
Railroad ballast	82	630	7.68
Other miscellaneous uses	91	514	5.65
Unspecified: 2/			
Actual	7,100	22,500	3.16
Estimated	541	4,610	8.53
Total or average	9,380	35,900	3.83

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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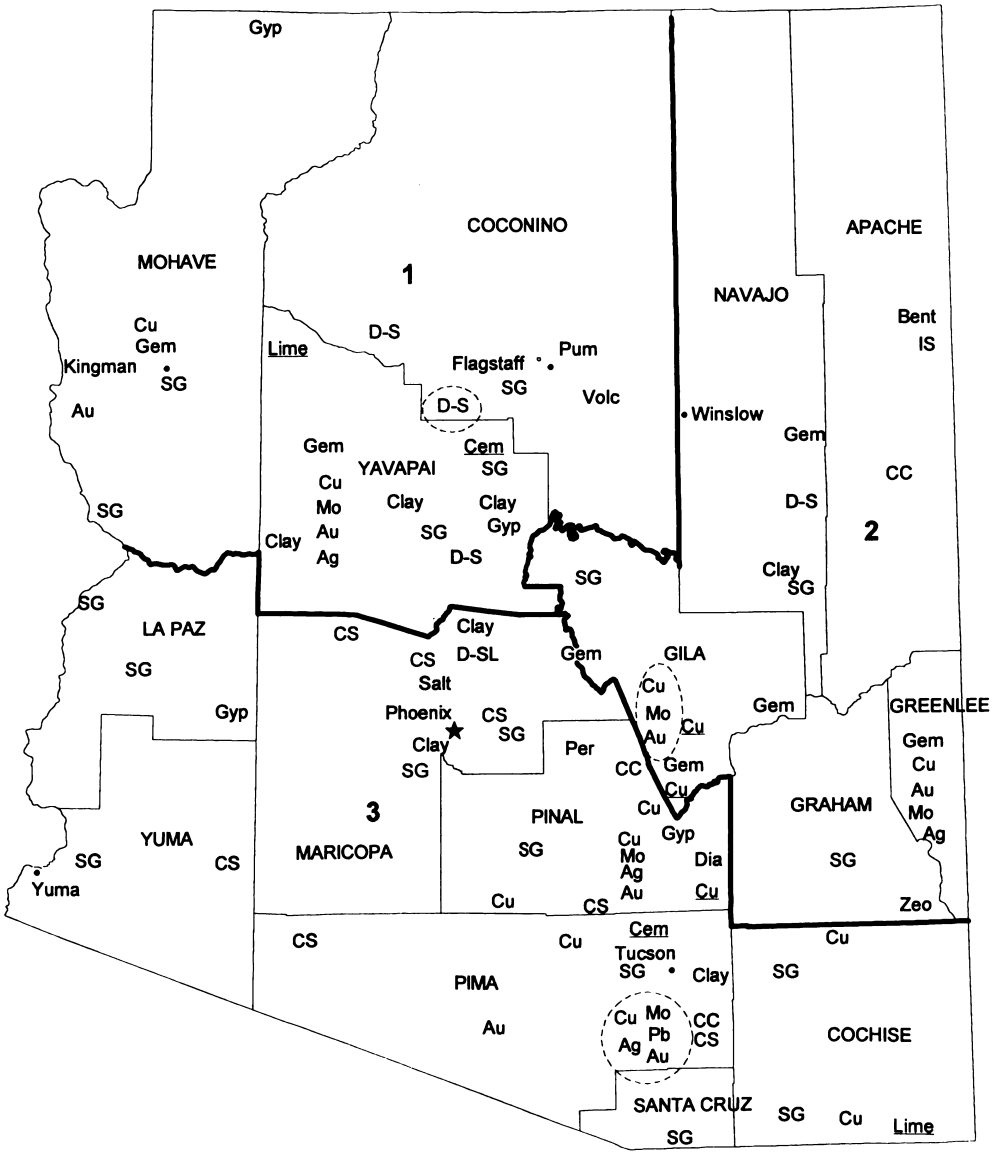
ARIZONA



LEGEND

- State boundary
- County boundary
- ★ Capital
- • City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Ag	Silver
Au	Gold
Bent	Bentonite
Cem	Cement plant
Clay	Clay
CC	Calcium carbonate
CS	Crushed stone
Cu	Copper
Cu	Copper plant
D-S	Dimension sandstone
D-Sl	Dimension slate
Dia	Diatomite
Gem	Gemstones
Gyp	Gypsum
IS	Industrial sand
Lime	Lime plant
Mo	Molybdenum
Pb	Lead
Per	Perlite
Pum	Pumice
Salt	Salt
SG	Sand and gravel
Volc	Volcanic cinder
Zeo	Zeolite
⬭	Concentration of mineral operations

0 — 100 Kilometers

Source: Arizona Department of Mines and Minerals Resources/U.S. Geological Survey

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THE MINERAL INDUSTRY OF ARIZONA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Arizona Department of Mines and Mineral Resources for collecting information on all nonfuel minerals.

In 1997, for the ninth time in the past 10 years, Arizona led the Nation in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). Arizona's mineral production had an estimated value of $3.52 billion, a 1.7% decrease from the $3.58 billion of 1996; following a 14.6% decrease from 1995 to 1996 (based on final 1996 data). The State accounted for about 9% of the value of U.S. total nonfuel mineral production.

Arizona continued as the top copper-producing State, accounting for 64% of total U.S. copper mine production and value. Copper was the State's leading nonfuel mineral, representing 83% of the total value. Most of the State's decrease in value resulted from decreases in copper, gold, and silver. Compared with that of 1996, the values of all other nonfuel minerals increased with the exception of those of construction sand and gravel, crude gypsum, and crushed stone.

The State's 1996 decrease in total nonfuel mineral production value mainly resulted from declines in average copper and molybdenum prices. Copper mine production increased by 6% in 1996, but its value decreased by about 18%. In 1995, both production and price increased resulting in a 30% increase in value.

Based on USGS estimates of the quantities produced in the United States during 1997, Arizona remained first in the production of molybdenum, second in perlite, fourth in silver, and fifth in pumice and pumicite. The State climbed from fifth to third in gemstones (by value) and dropped from fifth to sixth in construction sand and gravel. Additionally, Arizona was a significant producer of portland and masonry cement, gypsum, lime, and dimension stone.

The following narrative information was provided by the Arizona Department of Mines and Mineral Resources[2] (ADMMR). ASARCO Incorporated began mining the Silver Bell North copper oxide deposit and dedicated the solvent extraction-electrowinning (SX-EW) facility in July 1997. The joint venture with Mitsui & Co. U.S.A. (25% share) is expected to produce 16,000 metric tons of copper annually. Much of the oxide ore will come from the new pit, Silver Bell North, with reserves of 179 million tons grading 0.39% copper. Rubblization and leaching of material in the El Tiro and Oxide pits will also provide solution to the SX-EW plant. Capital costs were reduced by using mining equipment from the Ray and Mission Mines.

Copper production at the Ray Mine was up from 1995, to 156,000 tons, because of increased ore production as a result of improved efficiency and access to high-grade ore following completion of a stripping program. Efficiency was increased, in part, by adding three new 218-ton capacity trucks and a new 43-cubic-meter shovel. Late in 1996 the mine began testing a prototype truck, the Haulpak 930E Komatsu with a capacity of 281 tons. Six smaller 154-ton capacity trucks were freed for use at the Silver Bell Mine. By yearend, the Ray Mine had reserves of 897 million tons grading 0.6% copper (ASARCO Incorporated, Form 10-K405, accessed March 17, 1998, at URL http://www.sec.gov/Archives/edgar/data/7649/0000007649-97-000003.txt).

At the Mission Mine, ore production and average grade increased as the underground mine came on-line, supplying high-grade ore. In 1996, production totaled 118,000 tons of copper and 363 tons of molybdenum. The Mission Mine was Arizona's largest silver producer with 61 tons recovered as a byproduct. Developmental drilling increased copper reserves to 485 million tons containing 3.4 million tons of copper. The drilling also identified long-term stripping requirements that led Asarco to install a conveyor system to move 53 million tons of waste per year and purchase two new 46-cubic-meter capacity shovels. These actions allowed three 11-cubic-meter capacity shovels to be moved to the Silver Bell Mine.

Broken Hill Proprietary (BHP) Copper Co.'s San Manuel Mine, the largest underground operation in the United States, produced 107,000 tons of copper for the fiscal year ending May 1, 1997. The Lower Kalamazoo ore body commenced production in January 1997. Production from the Lower Kalamazoo ore body will increase as the San Manuel ore body is depleted over the next few years. According to BHP's Report to Shareholders and the ADMMR, the ore reserves of the two deposits are 222 million tons of sulfide ore at 0.62% copper.

BHP's Florence insitu leach project has completed permitting and is scheduled to begin production in 1998. The operation is anticipated to produce 32,000 tons of cathode copper per year for 15 years. The project is in a testing phase that includes a pilot insitu leach and SX-EW plant. Oxide resources for the project are 291 million tons averaging 0.34% copper.

In 1996 Cyprus Sierrita Corp. started mining a 63-million-ton oxide deposit that has led to an increase in cathode output,

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html.

[2]Nyal J. Niemuth, Mining Engineer, authored the text of State minerals information provided by the Arizona Department of Mines and Mineral Resources.

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according to the company's 1996 Annual Report. Construction has begun on a new in-pit crusher and conveyor system to reduce haulage costs. A major contribution to the mine's success is a byproduct molybdenum credit of 8,600 tons, valued at $100 million in 1996. Sierrita is the largest producer of molybdenum in Arizona.

Equatorial Mining N.L. of Australia exercised their option to purchase the Mineral Park Mine from Cyprus on October 1, 1997. The company plans to double production of the SX-EW operation that produced 2,300 tons of copper for Cyprus in 1996. Cyprus' Tohono operations, located on land leased from the Tohono O'Odham Nation, consists of an SX-EW plant fed by an experimental open pit and heap leach. In 1996 Tohono produced 18,000 tons of copper, however Cyprus suspended mining in July 1997.

Investments in the smelter and refinery at Miami have made Cyprus more efficient and self-sufficient in domestic copper smelting and refining. The smelter processed a record 574,000 tons of copper concentrates in 1996.

Phelps Dodge Corp.'s Morenci Mine in Greenlee County, the largest copper mine in North America, produced over 454,000 tons of copper in 1996. The Morenci Mine produces about 25% of the U.S. copper production and 5% of the world's production. The Morenci operation consists of the Morenci, Metcalf, and Northwest Extension open pit copper mines, the 91,000-ton-per-day Morenci concentrator with a molybdenum recovery circuit, the 36,000-ton-per-day Metcalf concentrator, and four dump leaches with three SX plants. The Morenci operation also includes the new Southside EW plant, with a 59,000-ton capacity, and Morenci, with an annual capacity of 168,000 tons, the worlds largest EW plant. Following testing of the Haulpack 930 E 290-ton capacity trucks at Phelps Dodge's Chino Mine in New Mexico, the company purchased a fleet of 39 of the new large haulers, 28 of which are scheduled for service at Morenci in 1997.

In 1997 Phelps Dodge announced that a $238 million construction project is planned for the New Cornelia Mine at Ajo. The New Cornelia operation, which will employ about 400 people, is expected to produce 61,000 tons of copper and 780 kilograms of gold per year, perhaps as early as 2000. The project is scheduled to include a new concentrator and used mining equipment, allowing resumption of mining of the deposit that last operated in 1983. The sulfide resource is 136 million tons grading 0.56% copper. Novel features of the planned concentrator include the largest semiautogenous grinding (SAG) mill in Arizona, which is 10 meters in diameter by 5 meters wide and powered by an 11 meter in diameter wrap around drive motor. This 15,000 horsepower electric motor will also be the largest in Arizona. After screening, the feed will be supplied to the world's largest ball mill measuring 7 meters in diameter by 12 meters long.

Carlota Copper Co., subsidiary of Cambior U.S.A., was granted their long awaited Environmental Impact Statement and Record of Decision in July 1997 from the Tonto National Forest for their Carlota project. The company still awaits approval from the Environmental Projection Agency and the Bureau of Reclamation. The delays and lower copper prices caused Cambior to schedule the close of their construction office for January 1998.

In October 1997, AMT International Mining Corp. announced the completion of a feasibility study on their Copper Creek deposits located 45 miles northeast of Tucson. The exploration project includes the Old Reliable, Child Aldwinkle, and Copper Prince breccia pipes and encompasses joint venture property with BHP and Phelps Dodge.

According to ADMMR, Arizona's 1996 gold production exceeded 3,100 kilograms. Addwest Minerals Inc.'s Gold Road Mine in Mohave County added over 1,200 kilograms to the approximately 1,900 kilograms of byproduct production from its copper mines. According to the company, as of January 1997 the underground Gold Road Mine had about 3 years of reserves totaling 475,000 tons at 7.9 grams per ton. Addwest conducted exploration drilling on the nearby Moss Mine that contains a 6.7-million-ton resource grading 1.16 grams per ton. Addwest's parent company, Addwest Minerals International Ltd., became a publicly traded company in early 1997. The Bureau of Land Management's publishing of the draft Environmental Impact Statement for Bema Gold Corp.'s proposed open pit heap leach Yarnell project has been delayed and is now expected to be released in early 1998. Royal Oak Mines, Inc. reported promising intercepts as it continued drilling the Copperstone gold deposit for a possible underground mine.

In 1996, Salt River Sand & Rock Co., in Maricopa County, continued to operate the second largest sand and gravel plant in the Uni ted States. Acquisitions, mergers, and dissolutions have changed the corporate structure of Arizona's industrial mineral mining industry. Omya (Arizona) Inc. [Pluess Staufer] acquired the Queen Creek Limestone deposit previously operated by Mineral Development Inc. Omya has announced plans to construct a marble grinding mill near Superior in Pinal County. Minerals Development Inc., in agreement with Omya, will continue to supply the market with crushed and screened marble products of a particle size greater than 200 mesh. Georgia Marble Co. acquired the Santa Rita quarry and plant in Pima County from Specialty Minerals Inc. under a long-term lease and announced plans to concentrate their Arizona operations at the newly leased location. Superior Companies, Inc. sold its Camp Verde Gypsum Mine to Phoenix Cement Co. and sold its other mines including the Verde Valley sand and gravel operation, Winkleman Gypsum, and the idle St. Johns limestone mine to United Metro. Pioneer Concrete of America, through its Pioneer Concrete of Arizona subsidiary, acquired Cashway Concrete and Materials Co. in Phoenix. Pioneer of Australia is the parent company of Pioneer Concrete and is reported to be the second largest sand and gravel producer in the world.

The Salt River Project's Navajo Power Plant at Page began receiving limestone from Chemical Lime Co. in Nevada for a new flue gas desulfurization plant. At full capacity, approximately 163,000 tons of limestone will be received annually from the Nevada quarry 402 kilometers away. The desulfurization produces gypsum as a waste product.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN ARIZONA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995		1996		1997 p/	
		Quantity	Value	Quantity	Value	Quantity	Value
Clays:							
Bentonite		21	W	W	W	W	W
Common		98	449	104	W	91	W
Copper 3/		1,170	3,560,000	1,240	2,980,000	1,230	2,930,000
Gemstones		NA	3,230	NA	2,360	NA	3,220
Gold 3/	kilograms	1,920	23,900	1,740	21,800	W	W
Iron oxide pigments, crude	metric tons	68	90	W	W	W	W
Sand and gravel:							
Construction		40,100	201,000	41,900	199,000	40,400	197,000
Industrial		334	2,910	323	2,890	319	3,220
Silver 3/	metric tons	220	36,400	188	31,300	159	22,300
Stone, crushed		5,520	32,600	6,800	40,600	6,100	38,000
Combined value of cement, gypsum (crude), lime, molybdenum, perlite (crude), pumice and pumicite, salt, stone (dimension sandstone), and values indicated by symbol W		XX	331,000	XX	308,000	XX	325,000
Total		XX	4,190,000	XX	3,580,000	XX	3,520,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Recoverable content of ores, etc.

TABLE 2
ARIZONA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	4	2,550	$14,000	$5.48	6	4,110	$23,000	$5.60
Granite	11 r/	1,940 r/	10,800 r/	5.56 r/	12	1,540	8,580	5.57
Marble	3	W	W	6.09	3	W	W	8.24
Sandstone and quartzite	2	W	W	14.62	2	W	W	12.58
Volcanic cinder and scoria	4	135	416	3.08	5	238	W	W
Miscellaneous stone	2	W	W	8.88 r/	2	W	W	9.04
Total	XX	5,520	32,600	5.91	XX	6,800	40,600	5.97

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits except unit value; may not add to totals shown

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TABLE 3
ARIZONA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/ 3/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch), riprap and jetty stone	41	$123	$3.00
Coarse and fine aggregates:			
Graded road base or subbase	56	96	1.71
Unpaved road surfacing	105	158	1.50
Terrazzo and exposed aggregate	616	4,480	7.27
Other construction materials 4/	34	176	5.18
Agricultural, poultry grit and mineral food	(5/)	(5/)	10.75
Chemical and metallurgical:			
Cement manufacture	(5/)	(5/)	6.61
Lime manufacture	(5/)	(5/)	5.51
Special:			
Whiting or whiting substitute	(5/)	(5/)	10.96
Other specified uses not listed	2,630	15,800	6.00
Unspecified: 6/			
Actual	222	1,790	8.07
Estimated	3,100	18,000	5.82
Total	6,800	40,600	5.97

1/ To avoid disclosing company proprietary data; "District tables were not produced in 1996."
2/ Includes granite, limestone, marble, miscellaneous stone, sandstone and quartzite, and volcanic cinder and scoria.
3/ Data are rounded to three significant digits except unit value; may not add to totals shown.
4/ Includes screening (undesignated).
5/ Withheld to avoid disclosing company proprietary data; included with "Other specified uses not listed."
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 4
ARIZONA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	13,700	$73,000	$5.34
Plaster and gunite sands	674	3,140	4.66
Concrete products (blocks, bricks, pipe, decorative, etc.)	247	1,180	4.78
Asphaltic concrete aggregates and other bituminous mixtures	4,650	27,200	5.85
Road base and coverings 2/	7,830	29,600	3.79
Fill	956	3,330	3.49
Other miscellaneous uses 3/	591	2,660	4.51
Unspecified: 4/			
Actual	7,050	32,100	4.55
Estimated	6,250	26,900	4.30
Total or average	41,900	199,000	4.75

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes filtration and snow and ice control.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 5
ARIZONA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	284	1,960	172	955	14,100	74,400
Asphaltic concrete aggregates and road base materials 3/	507	3,710	398	2,290	12,500 4/	54,200 4/
Other miscellaneous uses 5/	8	41	11	117	572	2,510
Unspecified: 6/						
Actual	368	1,320	--	--	6,680	30,800
Estimated	2,410	10,900	1,110	4,260	2,740	11,700
Total	3,570	17,900	1,690	7,620	36,600 4/	174,000 4/

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill and road and other stabilization (cement).
4/ Includes unspecified within all districts.
5/ Includes filtration and snow and ice control.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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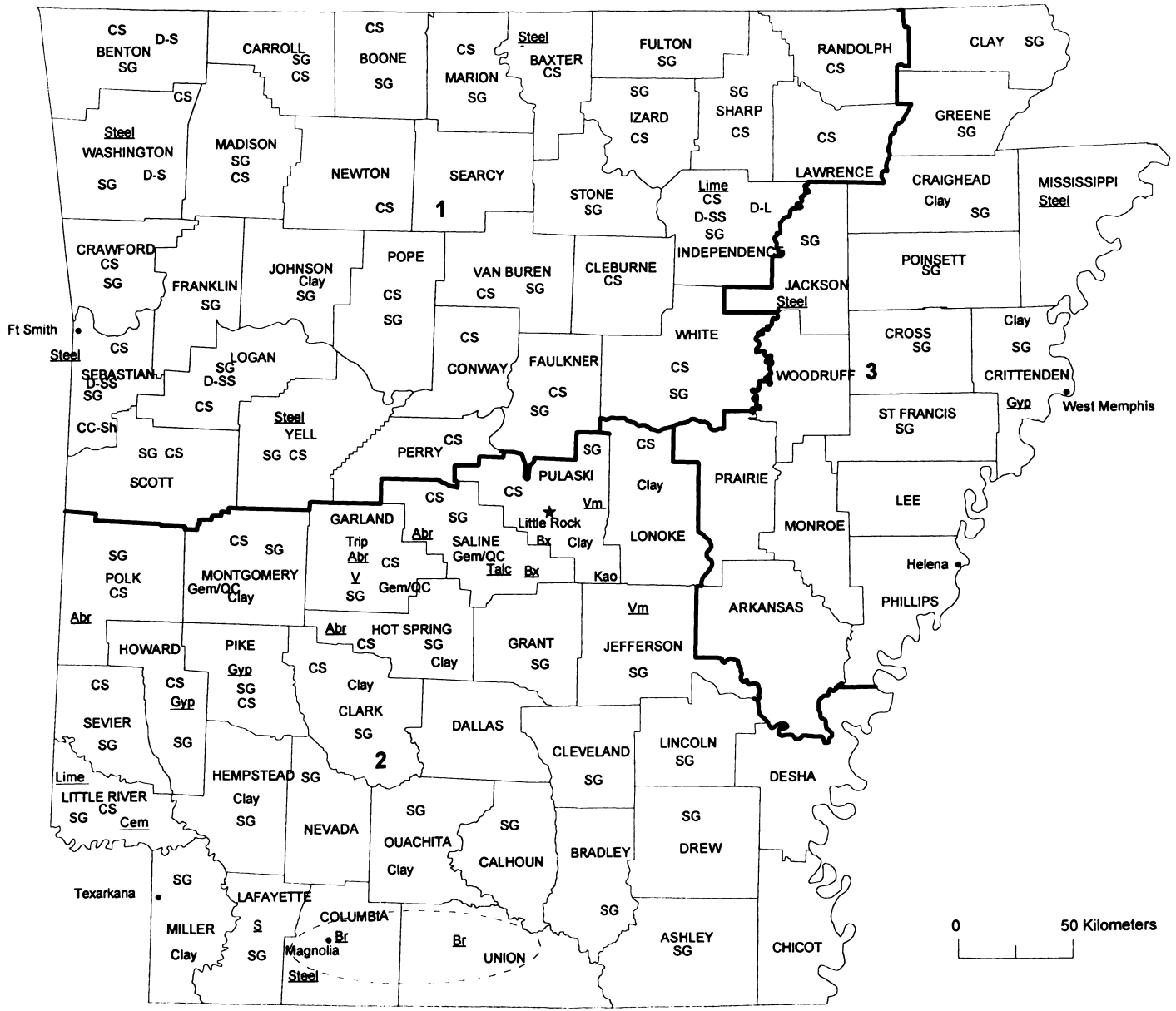
ARKANSAS



LEGEND

- State boundary
- County boundary
- ★ Capital
- • City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Abr	Abrasives plant
Br	Bromine plant
Bx	Bauxite
Bx	Bauxite plant
CC-Sh	Common clay and shale
Cem	Cement plant
Clay	Clay
CS	Crushed stone
D-S	Dimension stone
D-SS	Dimension sandstone
D-L	Dimension limestone
Gem/QC	Quartz crystal
Gyp	Gypsum plant
Kao	Kaolin
Lime	Lime plant
S	Sulfur plant
SG	Sand and gravel
Steel	Steel plant
Talc	Talc processor
Trip	Tripoli
V	Vanadium plant
Vm	Vermiculite plant
	Concentration of mineral operations

Source: Arkansas Geological Commission/U.S. Geological Survey

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THE MINERAL INDUSTRY OF ARKANSAS

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Arkansas Geological Commision for collecting information on all nonfuel minerals.

In 1997, Arkansas climbed in rank from 31st to 25th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $535 million, a 23% increase from that of 1996. This followed an 11.6% decrease from 1995 to 1996 (based on final 1996 data). The State accounted for more than 1% of the U.S. total nonfuel mineral production value.

In 1996, Arkansas' increase in value was mainly attributable to a rise in bromine production and value. Increases in construction sand and gravel, crushed stone, and portland cement also contributed to the State's increased value. Common clays and gemstones showed decreases in value. These decreases were small compared to the changes in other commodities. In 1995, the largest portion of Arkansas' decrease in nonfuel mineral value came from bromine. Construction sand and gravel and crushed stone also contributed significantly to the State's drop in value.

Based on USGS estimates of quantities produced in the 50 States during 1997, Arkansas continued to be the leading bromine-producing State, accounting for most U.S. production. Michigan was the only other State that produced bromine. Mining operations in both States extracted subsurface bromine-rich natural brines by submersible pump for subsequent processing. Arkansas also remained third in tripoli; fourth in kaolin; and ninth in common clay. Because of the difficulty in establishing a common physical unit that properly measures quantities of gemstones produced, gemstone production is measured in dollars. By value, Arkansas was fourth in the Nation in the production of gemstones. Additionally, significant quantities of crushed stone and crude gypsum were produced in the State. The State's mines exclusively produced industrial minerals; no metal mining has been reported in Arkansas since 1991, when bauxite and vanadium ore mining ceased following decades of production. The State's metal production, mostly raw steel, resulted from materials received from other domestic and foreign sources.

The following narrative information was provided by the Arkansas Geological Commission[2] (AGC). In exploration activities, Midwest Mining Supplies, Nashville, AR, has begun prospecting for base-metals in Polk and Montgomery Counties. Phase II evaluation of the Crater of Diamonds State Park began in early October 1996 with the excavation of trenches. Fourteen trenches yielded approximately 8,000 metric tons of ore for processing. Rock removed was transported under tight security to Texas Star's testing plant northeast of the State property. Processing of rock from the trenches, along with the drilling of several additional core holes of the northern edge of the pipe, was completed in early 1997. Total diamond recovery from the processing operation consisted of 210 diamonds, weighing a total of 45,748 carats. No individual stones were recovered that weighed over 2 carats. The pipe was found to be some 32 hectares in area, with 3 hectares being covered by quaternary and recent alluvial sediments. The final Phase II report was presented to the Arkansas Department of Parks and Tourism in late October. Exploration of the Crater of Diamonds State Park is finished and will not be considered again for a period of 20 years.

In other exploration news, Arkola Sand and Gravel Co. continued exploration for additional quarry sites in several formations in the western portion of the Arkansas River Valley. Gifford-Hill Co. explored a site for crushed stone in the Jackfork Sandstone (Pennsylvanian Age) near Delight in Pike County. McClinton-Anchor, Inc. proceeded with exploration for new aggregate quarry sites, mostly examining limestones (Mississippian) in the Ozarks Plateau region of northwest Arkansas. Mid-State Materials, Inc., continues to crush and explore a variety of igneous and contact metamorphosed Paleozoic rocks at its 51 quarry operations near Magnet Cove in Hot Spring County. Provo Co., based in east Texas, began sporadic processing of dump material from the HMB quarry in the Jackfork Sandstone (Pennsylvanian) in Sevier County. Rock Products Inc., continues to explore the potential of rock aggregate resources in Morrowan and Atokan (Pennsylvanian) sandstones in Cleburne and White Counties. Rogers Group Inc., has acquired the rights to three M & M Co. quarries in sandstones of the upper and middle Atoka (Pennsylvanian) at Toad Suck in eastern Perry County, north of Greenbriar, and at Beryl in Faulkner County. The company is actively crushing this rock and proceeding with explorations. The company also acquired the Tidwell quarry in the Arkansas Novaculite (Mississippian-Devonian) in Hot Spring County. They are currently crushing the rock for aggregate and fill material, and are also investigating its potential as a high-silica resource for ferrosilicon use. Searcy Asphalt and Material Inc. continues to test the upper Morrowan sandstone (Pennsylvanian)

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

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[2]J. Michael Howard, Geologist Supervisor, authored the text of State minerals information provided by the Arkansas Geological Commission.

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at its quarry operation at Judsonian in White County. Texas Industries Group continued the evaluation of tuff from its leased property in southern Polk County.

Albemarle Corp., a major bromine producer, began construction of a dedicated production facility at its Magnolia, AR, site. The facility is targeted to start up in February 1998. The new plant will have an initial capacity of 2,250 tons per year and is expandable to twice that production. Albemarle also announced plans to build a world-class production facility for the flame retardant tetrabromobisphenol-A. The plant project is to be located at Magnolia, AR, and is targeted to start up late in 1998 to early 1999. Brominated flame retardants are used in epoxies, phenolics, polystyrene, polycarbonates, and unsaturated polyesters.

Ash Grove Cement Co. is the only cement manufacturer in the State and maintains the Rocky Point plant operations in Little River County. Source materials include chalk from the Annona Chalk and silica from the Marlbrook Marl, both formations are Late Cretaceous in age.

Bennett Brothers Stone Co. Inc. obtains rough field stone, dimension stone, and other building stone materials from deposits in Garland County and nearby counties. Bobby Plant Asphalt Co., based in Murfeesboro, Pike County, has opened a major quarry in the Jackfork Sandstone (Pennsylvanian) south of Kirby in central Pike County. Duffield Stone and Gravel Co. opened its new Gumlog quarry in upper Atoka sandstone (Pennsylvanian) in Pope County and also are proceeding with further exploration in the region.

McGeorge Construction Co.'s Granite Mountain quarry operations, the State's largest, suffered major damage from a tornado on March 1, 1997. Quarry #2 was down for approximately 60 working days. Quarry #1 utilized all employees from both sites on a 24-hour, 7-day a week basis until both facilities were back up to original capacity. Out of 200 employees, 2 were seriously injured by the tornado, and 5 additional employees were taken to local hospitals for minor injuries, no deaths occurred. After 4 days of cleanup, portable crushers were brought into Quarry #2 , but the usual variety of sizes of crushed stone were not producible from the portable equipment. Consequently, there was an anticipated shortfall of certain sizes of crushed stone available in central Arkansas, as the combined output of the two quarries was about 4.5 million tons per year before the damage. Of 40 buildings on the quarry sites, 30 were destroyed, and the remainder suffered some damage. At Quarry #1 minor damage occurred to the belt distribution system and was repaired in a few days. However, the belt distribution system at Quarry #2 for stacking crushed stone was 90% destroyed. A new belt system that was in the process of being built suffered only minor damage, apparently because the belts had not been installed. The wind resistance of the belts was the apparent cause of the destruction of the primary stacking system. A 54-metric-ton Komatsu trackloader was destroyed when a section of the conveyor system fell on it, crushing the cab and bending the front hydraulic arm system beyond repair. The primary crusher house was destroyed along with a large percentage of the electrical supply lines, making the primary crusher system inoperative at Quarry #2. The new computerized hot mix asphalt plant on the Granite Mountain #2 site was slightly damaged and was quickly repaired.

Meridian Co. continued its production activities at the Hatton quarry in southern Polk County. Until this year, all the Hatton Tuff lentil of the Stanley Shale (Mississippian) produced by the company was being shipped to east Texas. However, in 1997, riprap and fill rock from this quarry was used on U.S. Highway 71 construction extending from south of Lockburg in Sevier County to Wilton in northern Little River County.

Schwartz Stone Co. quarried sandstone from the Hartshorne Sandstone (Pennsylvanian), north of Midway in Logan County, for use as crushed aggregate and dimension stone. Texas Industries Group continued the evaluation of tuff from its leased property in southern Polk County. Vulcan Materials Co. Birmingham, AL, has acquired the rights to the L & R quarry in middle Atoka sandstone (Pennsylvanian) near Floyd in White County. Vulcan is proceeding with dolomitic limestone production from lower Ordovician age rocks near Black Rock in Lawrence County.

There continues to be a major use of rock from about 30 privately operated quarries on paper company lands of Weyerhauser and International Paper Co. The crushed rock is used in the numerous company-constructed timber access roads on their lands. Most counties in the Paleozoic region (northwestern half of the State) have their own county quarries. The materials from these quarry operations are used by the counties for aggregate and road fill purposes. Several major communities also have large quarry operations to supply public need for crushed stone and fill material.

Boral Ltd., an Australia-based company, sold the Briar Gypsum Co.'s properties for $94.5 million to James Hardie Gypsum LTD. of Australia on February 1, 1997. In mid-November, James Hardie Gypsum announced a $60 million expansion of its Nashville plant (formerly known as Briar plant). The expansion will double the facilities wallboard production capacity to 1.4 billion square feet per year and will result in an additional 75 to 80 jobs at the plant, which presently employs about 370 people. The company has seen it's U.S. gypsum business nearly quadruple in the past year. Production for 1997 was 590,000 tons of raw gypsum ore from which 65,000 square meters of wallboard was produced. The plant has proven 30-year reserves on the site. Principal markets for the company's wall board products are Alabama, Kentucky, Mississippi, and Indiana.

Bill Harrison Gypsum Co. of Oklahoma began stripping overburden north of Highland, Pike County, to expose massive gypsum beds immediately northeast of the previous mine site (Highland Gypsum Mine). Overburden from the new mine is being used to back fill the previous site. Gypsum from this operation is consumed as a cement additive by Ashgrove Cement in Little River County.

Harbison-Walker Refractories Co. quarried and crushed novaculite from the Butterfield quarry site in Hot Spring County for its high-purity silica applications. Lascas Products Inc. has ceased operations of its facility near Jessieville, Garland County, and reportedly have the plant for sale. The company had been trucking its plant feedstock from mines northeast of the plant site in northern Saline County earlier this year. The Rogers Group currently is evaluating high-silica novaculite in the Ouachita Mountains for potential in the ferrosilicon and silicon markets.

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Wallis Whetstones Inc. continues to crush novaculite for high-silica demands at a site south of Lonsdale near the Saline-Hot Spring County line.

The four largest whetstone operators continue active manufacturing operations, with Norton Abrasive Co. and Smith Whetstones leading the way. The relatively new Norton plant in southern Garland County affords these companies better continuity of operations than the previous procedure of shipping the raw rock out of the State. Hall's Whetstones and Dan Kirshman are also expanding their activities and markets, principally for novaculite products.

An undisclosed company is exploring gravel deposits near Mayflower in southern Faulkner County. Gifford-Hill Co. did considerable testing of gravel deposits at a site near Prescott in Clark and Nevada Counties.

Milwhite Co. has abandoned its crusher facilities at Bryant and talc and slate pits in Saline County. The company has reportedly moved operations to Corpus Christi, TX.

Malvern Minerals Co. continues actively mining tripoli from a deposit in the upper Arkansas Novaculite (Mississippian) in eastern Garland County. Some tripoli is obtained from the Big Fork Chert (Ordovician) in a county-operated quarry in western Saline County.

Umetco completed reclamation of the Christy vanadium pit near Magnet Cove in Hot Spring County in the spring of 1997. The last production of vanadium ore from this site was in 1990.

In other developments, three new publications by the AGC were completed and published in 1997. Information Circular (IC) 34 describes the ilmenite deposits drilled immediately northwest of Mineral Springs in Howard County. IC 35 presents the results of a regional geochemical survey of the distribution of arsenic, chromium, copper, lead, nickel, silver, and zinc in rocks of the Ouachita Mountains region of Arkansas. Bulletin 24 describes the mineral, fossil-fuel, and water resources of the entire State. The publication examines about 63 resources, including references. All of these publications are currently available from the Maps and Publications section of the AGC.

From 1995 through 1997, geologic mapping was completed and open-file copies of fifteen 7½-minute topographic quadrangles in southwest Arkansas were made available. The AGC has accomplished this work as a cooperative program with the USGS. The USGS STATEMAP program partially funds the project. Five quadrangles are presently being digitized using ARCVIEW 3.0 software and are scheduled for completion by summer 1998.

The Center for Energy, Natural Resources, and Environmental Studies (CENRES) at Arkansas Tech University, Russellville, is nearing completion of a study of the relationships between the various geologic units being quarried in the Paleozoic region of Arkansas and certain engineering properties of the rock (principally the Los Angeles abrasion and sodium sulfate soundness tests). The AGC, the Arkansas Highway and Transportation Department, and the U.S. Army Corps of Engineers are cooperating in this study by supplying base maps and engineering test data to CENRES.

The U.S. Forest Service (USFS) had 83 mining contracts that produced 105,000 tons of building stone, rip-rap, and aggregate-related materials (shale and chert), which generated about $43,000 in revenue for the Federal Government. Forty-five quartz mining contracts with the USFS on the Ouachita National Forest in Arkansas generated around $22,000 in revenue. About 627 tons of quartz were removed from quartz mines on the National Forest. Annual nonfuels lease payments on Arkansas' National Forests (Ouachita, Ozark, and St. Francis National Forests) is estimated at $80,000.

In cooperation with the USFS and the State Geological Surveys of Oklahoma and Missouri, the AGC participated in a fact-finding effort for the USFS Ouachita-Ozark Highlands Assessment study (OOHA). Every 10 years the USFS is required to establish planning guidelines for forest and land use for the next decade. The major product will be a report on various aspects of the National Forests in this region (the Ozark National Forest (NF), the Ouachita NF, and the Mark Twain NF). The three NF's coordinated their efforts to study the regional assessment area. Present in this report is a summary of the mineral data for the assessment region. The individual State-based data reports are on an accompanying CD-ROM. This is the fact-finding report on which policy decisions will be made for the next 10 years. The actual policy report for the three NF's must be completed by the year 2001.

During the 1997 legislative session, Senate bill 397 was introduced as an attempt to provide a framework for the State to be able to ensure the safe and environmentally sound operation and closure of new quarries. This bill was backed by industry. On April 8, 1997, Senate bill 397 was signed into law by the Governor as Act 1166 of 1997. Major points of the act include safety provisions during and after quarry operations as a site, as well as providing for reclamation of various areas disturbed during the life of the quarry. The Arkansas Department of Pollution Control and Ecology is responsible for the enforcement of the act.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN ARKANSAS 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Common	973	2,920	939	2,390	1,170	2,160
Kaolin	182	4,890	161	W	164	W
Gemstones	NA	4,890	NA	3,050	NA	2,800
Sand and gravel, construction	11,600	48,300	11,000	43,500	11,900	48,400
Silica stone 3/	W	W	398	3,800	NA	NA
Stone:						
Crushed	25,500	169,000	26,400	158,000	27,000	162,000
Dimension	22,000	2,010	W	W	W	W
Combined value of bromine, cement, clays (fire), gypsum (crude), lime, sand and gravel (industrial), stone [dimenson limestone, marble, and sandstone (1996-97)], tripoli, and values indicated by symbol W	XX	260,000	XX	225,000	XX	320,000
Total	XX	492,000	XX	435,000	XX	535,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Grindstones, pulpstones, and sharpening stones; excludes mill liners and grinding pebbles.

TABLE 2
ARKANSAS: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	15	6,890	$53,700	$7.80	23	7,260	$36,700	$5.05
Dolomite	1	W	W	4.00	1	W	W	4.25
Granite	6 r/	10,100 r/	75,500 r/	7.49 r/	6	9,720	75,100	7.72
Sandstone	16	5,970	28,500	4.77	18	6,850	33,800	4.94
Quartzite	2	W	W	5.03	2	W	W	5.02
Sandstone-quartzite	--	--	--	--	1	W	W	6.17
Miscellaneous stone	1	W	W	2.20	1	35	W	W
Total	XX	25,500	169,000	6.64	XX	26,400	158,000	5.96

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 3
ARKANSAS: CRUSHED STONE SOLD OR USED
BY PRODUCERS IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	352	$1,520	$4.30
Filter stone	116	732	6.31
Other coarse aggregate	W	W	6.64
Coarse aggregate, graded:			
Concrete aggregate, coarse	1,230	6,250	5.07
Bituminous aggregate, coarse	962	5,110	5.31
Bituminous surface-treatment aggregate	335	2,130	6.36
Railroad ballast	419	3,400	8.11
Other graded coarse aggregate	W	W	4.50
Fine aggregate (-3/8 inch), screening, undesignated 3/	538	2,410	4.47
Coarse and fine aggregates:			
Graded road base or subbase	4,080	18,800	4.61
Unpaved road surfacing	281	1,860	6.60
Crusher run or fill or waste	356	1,670	4.70
Other construction materials	125	698	5.58
Agricultural limestone 4/	211	1,310	6.21
Chemical and metallurgical:			
Cement manufacture	(5/)	(5/)	2.73
Lime manufacture	(5/)	(5/)	3.00
Special, other fillers or extenders	(5/)	(5/)	7.28
Unspecified: 6/			
Actual	13,700	92,800	6.75
Estimated	2,260	15,100	6.69
Total	26,400	158,000	5.96

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Includes dolomite, granite, limestone, miscellaneous stone, quartzite, sandstone, and sand-stone/quartz.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes stone sand (bituminous mix or seal).
4/ Includes other agricultural uses.
5/ Withheld to avoid disclosing company proprietary data; included in "Total."
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
ARKANSAS: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Construction aggregates:				
Coarse aggregate (+1 1/2 inch) 2/	295	1,580	173	665
Coarse aggregate, graded 3/	W	W	W	W
Fine aggregate (-3/8 inch) 4/	W	W	W	W
Coarse and fine aggregate 5/	3,680	17,300	1,030	4,990
Other construction materials	2,810 6/	14,500 6/	797	5,440
Agricultural 7/	211	1,310	--	--
Chemical and metallurgical 8/	(9/)	(9/)	(9/)	(9/)
Special 10/	--	--	(9/)	(9/)
Unspecified: 11/				
Actual	3,930	18,000	9,820	74,700
Estimated	(9/)	(9/)	--	--
Total	13,200	67,900	13,300	89,800

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone and riprap and jetty stone.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregates.
4/ Includes stone sand (bituminous mix or seal) and screening (undesignated).
5/ Includes graded road base or subbase, unpaved road surfacing, and crusher run (select material or fill).
6/ Includes other coarse aggregate.
7/ Includes agricultural limestone and other agricultural uses.
8/ Includes cement and lime manufacture.
9/ Withheld to avoid disclosing company proprietary data; included in "Total."
10/ Includes other fillers or extenders.
11/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
ARKANSAS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	4,360	$20,800	$4.78
Asphaltic concrete aggregates and other bituminous mixtures	1,050	5,180	4.95
Road base and coverings	487	1,190	2.45
Fill	103	319	3.10
Other miscellaneous uses 2/	9	34	3.78
Unspecified: 3/			
Actual	2,170	6,740	3.11
Estimated	2,790	9,250	3.31
Total or average	11,000	43,500	3.97

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filtration and snow and ice control.
3/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
ARKANSAS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregate	397	2,010	3,960	18,800
Asphaltic concrete aggregates and road base materials 3/	216	687	1,420	6,000
Other miscellaneous uses 4/	3	13	6	21
Unspecified: 5/				
Actual	2,140	6,590	25	140
Estimated	96	298	2,700	8,950
Total	2,860	9,600	8,110	33,900

1/ Production reported in "District 3" was included with "District 2" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes fill.
4/ Includes filtration and snow and ice control.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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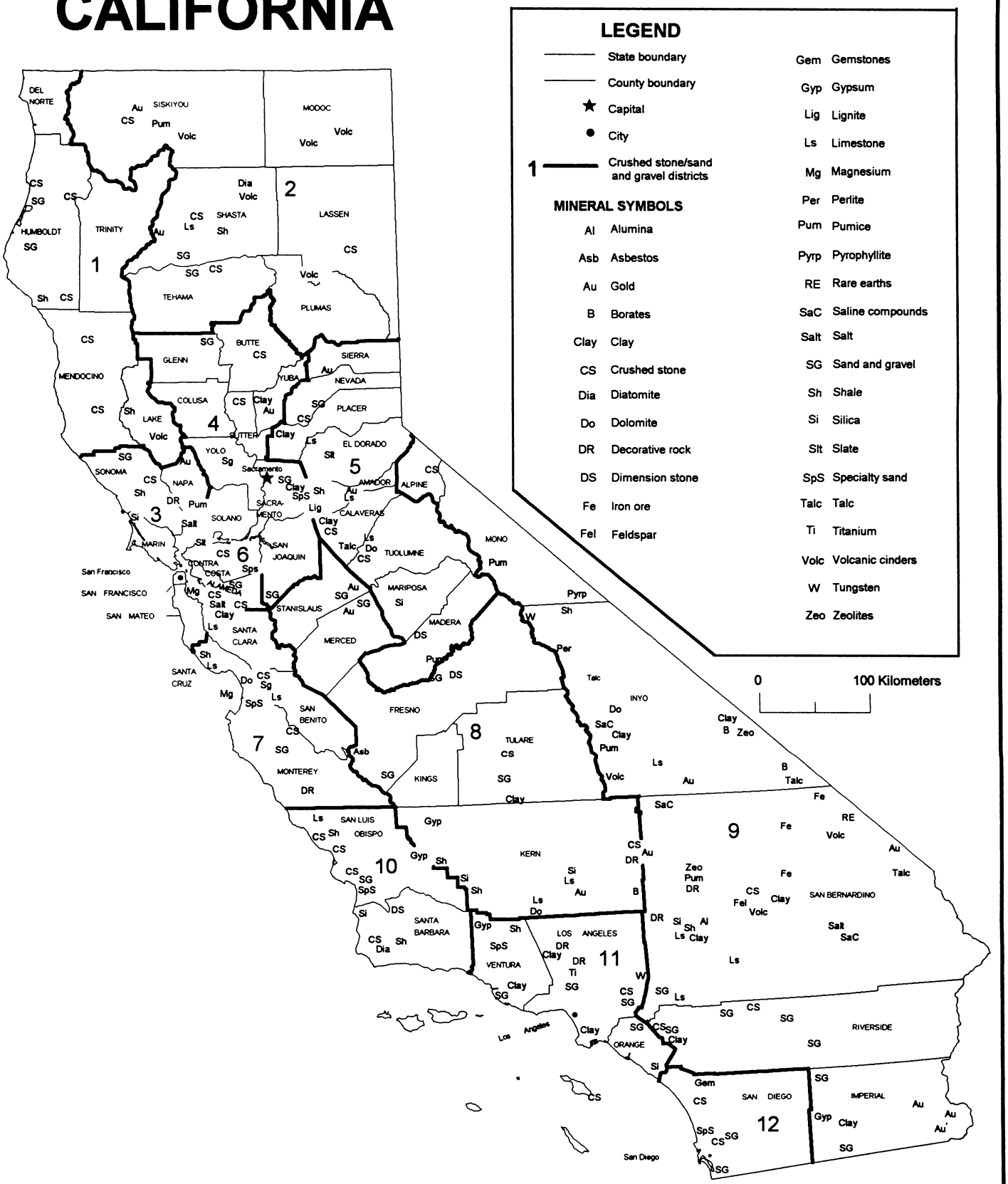
CALIFORNIA



Source: California Department of Conservation, Division of Mines and Geology/U.S. Geological Survey

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THE MINERAL INDUSTRY OF CALIFORNIA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the California Department of Conservation, Division of Mines and Geology, for collecting information on all nonfuel minerals.

In 1997, for the sixth consecutive year, California was the third leading State in the Nation in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $2.81 billion, a less than 1% decrease from that of 1996. This followed a 2.5% increase from 1995 to 1996 (based on final 1996 data). The State accounted for more than 7% of the U.S. total nonfuel mineral production value.

Industrial minerals accounted for more than 90% of California's nonfuel mineral value; the remaining value was mostly resulted from gold and silver mining. Portland cement, construction sand and gravel, boron minerals, and crushed stone, in descending order of value, were the leading industrial minerals in 1997, accounting for 81% of the State's total industrial nonfuel mineral value. Whereas the large majority of the State's nonfuel mineral commodities increased in value, only the values of portland cement and crushed stone increased sufficiently to somewhat moderate decreases in construction sand and gravel, lime (*table 1*), potash, and soda ash. In 1996, decreases in the values of boron minerals and gold were more than compensated for by significant increases in portland cement and construction sand and gravel.

Based on USGS estimates of the quantities produced in the United States during 1997, California continued as the Nation's only State to produce boron, rare-earth metal concentrates, and asbestos. The State remained first in the production of construction sand and gravel, diatomite, and portland cement, and first of two States that produced natural sodium sulfate. California continued second in feldspar and magnesium compounds; second of two States that produced soda ash and titanium; and second of two mercury-producing States. California also remained third in perlite production, fifth in kaolin, sixth in fuller's earth, crude gypsum, and talc, and ninth in masonry cement. California rose to third from fourth in pumice and pumicite; and dropped from second to third in gold, third to fourth in industrial sand and gravel and fire clays, fourth to fifth in bentonite, and seventh to eighth in salt and common clays. Additionally, significant quantities of crushed stone and dimension stone were produced in the State. The only potash producer closed operations during the year, but continued selling from its remaining stockpiles.

The following narrative information was provided by the California Department of Conservation, Division of Mines and Geology[2] (DMG). Canyon Resource Corp. conducted an exploration drilling project adjacently north and south of its permitted Briggs gold heap leach mine site. The project yielded 9,890 kilograms of additional resources, an increase of almost 50% from the initial 20,300 kilograms of permitted reserves at the Briggs site. Reconnaissance drilling by Canyon Resources revealed additional gold deposits at Pleasant Canyon, 14 kilometers north of the Briggs site. Further exploration will be necessary to determine if these deposits can be mined commercially. The Briggs Mine achieved full production in March 1997.

Royal Gold Inc. continued exploration at its Long Valley gold project in Mono County. The company has estimated probable gold reserves at 21,900 kilograms of gold.

Industrial Minerals

Permits for new and expanded sand and gravel operations were granted by several city, county, and Federal agencies. In January, Dumbarton Quarry Associates was granted a 10-year extension to mine aggregate at the Dumbarton Quarry, Alameda County, in return for building a fully renovated 37-hectare recreation facility which will be part of the East Bay Regional Park District.

Rosemary's Quarry (owned by Palomar Aggregates Inc.), San Diego County, was permitted in March. The quarry will provide about 20 million metric tons of crushed stone which will be produced over a period of about 20 years. The project also calls for a concrete and asphalt plant. After a long running debate over environmental and safety concerns, Artesia Ready Mix Concrete Inc. received approval in February to expand its Dry Creek sand and gravel operation in Tulare County from 16 hectares to 65 hectares, extending the life of the project for an additional 29 years. Opponents of the gravel operation are appealing the approval. At its aggregate operation near Woodlake, Tulare County, Kaweah River Rock Co. has proposed an 330-hectare expansion, which could keep the company in business for 40 more years. In September, Calaveras Materials Inc. completed its new asphalt plant in Fresno County. The new plant, which is capable of producing 4,360 tons of asphalt per day, is one of the largest in the San Joaquin Valley. The plant is the first step in the

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement) estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone, handset and request Document # 1000 for a telephone listing of all mineral commodity specialists or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Susan Kohler-Antablin, Associate Geologist, authored the text of information provided by the California Department of Conservations's Division of Mines and Geology.

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company's expansion plans for Fresno County, which also includes a proposed 184-hectare aggregate mining operation along the Kings River, currently in the permitting stages.

Mitsubishi Cement Corp. gained approval in September to expand its 77-hectare Cushenbury limestone operation near Lucerne Valley, San Bernardino County, by 14 acres. The expansion will increase Mitsubishi's limestone reserves by between 14.5 and 18 million tons and increase the life of the quarry by 8 to 10 years. Mitsubishi's Lucerne Valley cement plant led the State in cement production for the year.

Siting and permitting of mine operations continues to create local controversy. A court of appeal in San Bernardino County ordered the county to rescind its December 1994 approval of Owl Rock Product Co.'s (now Service Rock Inc.) aggregate mining operation along Wilson Creek. Service Rock has no plans to appeal the ruling.

Metals

Despite falling gold prices, gold mining continued to dominate California's metallic mineral production. Newmont Gold Co.'s Mesquite Mine in Imperial County led the State in production in 1997. Viceroy Gold Corp.'s Castle Mountain Mine was the State's second largest gold producer, followed closely by Homestake Mining Co.'s McLaughlin Mine. The McLaughlin Mine ceased mining in 1996 but will continue to produce gold from stockpiled ores until about 2005.

Viceroy Gold Corp.'s Castle Mountain Mine expansion project in San Bernardino County was approved by the county in November. Final approval by the United States Bureau of Land Management is expected to take place in January 1998. If approved, the expansion will extend the mine life to 2001.

Golden Queen Mining Co.'s Soledad Mountain Mine and heap leaching project, in Kern County, received its conditional use permit from the county in September. The permit process was completed in 19 months. Reserves are estimated at 43,500 kilograms of gold and 635,000 kilograms of silver. Production, estimated at about 3,730 kilograms of gold annually, is expected to commence next year. The mine, which will provide about 250 jobs, was reported by Golden Queen and the DMG to be well received by most local residents. With an estimated 54 million tons of overburden, the mine will be the largest earth-moving project in California.

The permitting process for Glamis Imperial Corp.'s proposed Imperial gold mining project in Imperial County continued throughout the year. Approximately 95 million tons of ore with an average grade of 0.55 grams per ton has been identified by the company.

Two gold mines ceased mining operations during 1997. Lassen Gold Mining Co. finished mining its ore body at the Hayden Hill Mine, Lassen County, in December. The mine will continue residual leaching of its gold pads through at least 1998. The Hayden Hill Mine had been in operation since June 1992. It was the fourth largest gold producer in the State for the year. The San Juan Ridge Mine, an underground drift mine operated by Siskon Gold Corp., Nevada County, ceased mining during the April-May time period. There are no plans to reopen the mine in the near future.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN CALIFORNIA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Asbestos	metric tons	10,200	W	9,550	W	9,070	W
Boron minerals		1,190	560,000	1,150	519,000	622 3/	503,000
Cement:							
Masonry		154	11,200	198	14,500 e/	202	15,000 e/
Portland		9,360	565,000	9,910	616,000 e/	10,100	641,000 e/
Clays:							
Bentonite		149	14,000	148	13,900	149	14,100
Common		1,420	14,500	1,340	12,600	1,310	11,700
Fire		11	311	60	W	33	397
Fuller's earth		224	W	224	W	225	33,300
Diatomite		318	W	W	W	W	W
Gemstones		NA	490	NA	507	NA	515
Gold 4/	kilograms	25,600	319,000	23,800	299,000	21,000	230,000
Lime		228	15,600	208	17,800	210	18,000
Rare-earth metal concentrates	metric tons	22,200	W	20,400	W	20,000	W
Sand and gravel:							
Construction		98,400	542,000	103,000	583,000	110,000	634,000
Industrial		1,710	38,300	1,760	40,500	1,780	42,300
Silver 4/	metric tons	14	2,240	22	3,610	22	3,140
Stone:							
Crushed		43,700 5/	268,000 5/	46,700	295,000	47,300	308,000
Dimension	metric tons	27,300	6,660	28,600	7,020	28,800	7,060
Combined value of clays (kaolin), feldspar, gypsum (crude), iron ore (usable), magnesium compounds, mercury, perlite (crude), potash (1995-96), pumice and pumicite, salt, soda ash, sodium sulfate (natural), stone [crushed dolomite and shell (1995)], talc and pyrophyllite, titanium concentrates [ilmenite (1996-97)], tungsten (1995), and values indicated by symbol W		XX	399,000	XX	408,000	XX	351,000
Total		XX	2,760,000	XX	2,830,000	XX	2,810,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Weight reported as B_2O_3 and is not comparable to prior years.
4/ Recoverable content of ores, etc.
5/ Excludes certain stones; kind and value included with "Combined value" data.

TABLE 2
CALIFORNIA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone	22	23,200	$131,000	$5:64	23	24,900	$145,000	$5.82
Dolomite	8	237	1,920	8.11	8	384	2,670	6.95
Marble	(2/)	(2/)	(2/)	(2/)	2	W	W	W
Shell	(2/)	(2/)	(2/)	(2/)	1	W	W	W
Granite	19	5,550 r/	34,300 r/	6.19 r/	19	5,490	33,600	6.12
Traprock	22 r/	7,410 r/	53,000 r/	7.16 r/	21	7,940	58,700	7.40
Sandstone and quartzite	6	863	5,810	6.73	4	668	3,670	5.49
Slate	3	160	1,790	11.21	2	W	W	W
Volcanic cinder and scoria	4	332	2,060	6.19	4	420	3,450	8.21
Miscellaneous stone	20 r/	5,930 r/	38,600 r/	6.51 r/	21	6,440	42,900	6.66
Total	XX	43,700	268,000	6.14	XX	46,700	295,000	6.31

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits except unit value; may not add to totals shown.
2/ Excludes marble and shell from State total to avoid disclosing company proprietary data.

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TABLE 3
CALIFORNIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	5	$35	$7.00
Riprap and jetty stone	680	6,660	9.80
Filter stone	321	1,960	6.12
Other coarse aggregate	38	366	9.63
Coarse aggregate, graded:			
Concrete aggregate, coarse	1,920	12,700	6.58
Bituminous aggregate, coarse	1,850	13,400	7.23
Bituminous surface-treatment aggregate	518	8,560	16.52
Railroad ballast	1,240	9,350	7.52
Other graded coarse aggregate	121	1,060	8.74
Fine aggregate (-3/8 inch):			
Stone sand, concrete	588	3,640	6.19
Stone sand, bituminous mix or seal	746	5,430	7.28
Screening, undesignated	239	1,350	5.66
Other fine aggregate	20	96	4.80
Coarse and fine aggregates:			
Graded road base or subbase	4,720	26,900	5.69
Unpaved road surfacing	47	363	7.72
Terrazzo and exposed aggregate	89	1,040	11.63
Crusher run or fill or waste	1,070	4,790	4.46
Other coarse and fine aggregates	738	4,410	5.97
Other construction materials 3/	1,420	11,900	8.44
Agricultural limestone 4/	138	1,960	14.22
Chemical and metallurgical, cement manufacture 5/	11,500	43,200	3.76
Special:			
Whiting or whiting substitute	(6/)	(6/)	33.33
Other fillers or extenders	(6/)	(6/)	32.99
Other specified uses not listed 7/	895	25,400	28.43
Unspecified: 8/			
Actual	4,760	34,100	7.16
Estimated	13,100	76,100	5.83
Total	46,700	295,000	6.31

1/ Includes dolomite, granite, limestone, marble, miscellaneous stone, sandstone and quartzite, shell, slate,
traprock, and volcanic cinder and scoria.
2/ Data are rounded to three significant digits except unit value; may not add to totals shown.
3/ Includes drain fields and roofing granules.
4/ Includes poultry grit and mineral food and other agricultural uses.
5/ Includes glass manufacture and sulfur oxide removal.
6/ Withheld to avoid disclosing company proprietary data; included with "Other specified uses not listed."
7/ Includes flour (slate).
8/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
CALIFORNIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 3		District 5		District 6		District 7	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 3/	439	3,900	354	2,940	W	W	134	1,230
Coarse aggregate, graded 4/	571	6,230	911	6,590	W	W	W	W
Fine aggregate (-3/8 inch) 5/	236	1,870	170	1,290	W	W	W	W
Coarse and fine aggregate 6/	1,760	10,500	1,040	6,080	W	W	2,030	11,100
Other construction materials 7/	145	1,110	536	4,390	2,180	16,800	3,820	25,000
Agricultural 9/	(8/)	(8/)	(8/)	(8/)	(8/)	(8/)	(8/)	(8/)
Chemical and metallurgical 10/	(8/)	(8/)	--	--	--	--	(8/)	(8/)
Special 11/	--	--	(8/)	(8/)	--	--	--	--
Other miscellaneous uses 12/	(8/)	(8/)	--	--	--	--	--	--
Unspecified: 13/								
Actual	147	862	40	279	(8/)	(8/)	--	--
Estimated	257	1,670	1,380	8,390	--	--	--	--
Total	4,210	30,200	4,470	30,900	2,440	18,400	8,870	49,800

Use	District 8		District 9		District 11	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	--	--	W	W	73	715
Coarse aggregate, graded 4/	--	--	400	3,410	187	945
Fine aggregate (-3/8 inch) 5/	(8/)	(8/)	(8/)	(8/)	42	188
Coarse and fine aggregate 7/	--	--	W	W	526	2,810
Other construction materials 8/	--	--	764	6,490	--	--
Agricultural 9/	--	--	--	--	(8/)	(8/)
Chemical and metallurgical 10/	(8/)	(8/)	6,040	18,200	(8/)	(8/)
Special 11/	--	--	(8/)	(8/)	(8/)	(8/)
Other miscellaneous uses 12/	--	--	(8/)	(8/)	--	--
Unspecified: 13/						
Actual	(8/)	(8/)	8	126	4,330	31,300
Estimated	4,630	26,900	3,440	22,200	3,350	16,900
Total	6,620	35,500	11,500	75,000	8,620	54,700

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Production reported in District 1and 2 was included with "District 3," District 4 was included with "District 5" and District 10 and 12 was included with "District 11" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
7/ Includes drain fields and roofing granules.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.
10/ Includes cement manufacture, glass manufacture, and sulfur oxide removal.
11/ Includes other fillers or extenders and whiting or whiting substitute.
12/ Includes flour (slate) and other specified uses not listed.
13/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 5
CALIFORNIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	36,100	$209,000	$5.78
Plaster and gunite sands	2,010	13,400	6.66
Concrete products (blocks, bricks, pipe, decorative, etc.)	707	5,460	7.72
Asphaltic concrete aggregates and other bituminous mixtures	13,800	88,000	6.36
Road base and coverings 2/	10,800	54,700	5.06
Fill	4,030	14,100	3.49
Snow and ice control	29	139	4.79
Other miscellaneous uses 3/	1,190	8,310	6.96
Unspecified: 4/			
Actual	20,000	119,000	5.97
Estimated	14,400	70,900	4.91
Total or average	103,000	583,000	5.65

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes filtration and railroad ballast.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
CALIFORNIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	358	2,910	221	1,330	674	5,900
Asphaltic concrete aggregates and other bituminous mixtures	509	4,760	215	1,530	(3/)	(3/)
Road base materials 4/	528	3,030	780	3,300	407	2,780
Other miscellaneous uses 5/	(3/)	(3/)	19	141	(3/)	(3/)
Unspecified: 6/						
Actual	(3/)	(3/)	--	--	791	7,020
Estimated	53	257	692	3,570	--	--
Total	1,490	11,100	1,930	9,870	2,110	17,700
	District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	4,640	29,700	802	5,130	3,230	23,300
Asphaltic concrete aggregates and other bituminous mixtures	3,310	20,900	344	1,890	1,660	12,400
Road base materials 4/	4,160	20,900	780	4,680	1,400	6,720
Other miscellaneous uses 5/	(3/)	(3/)	--	--	(3/)	(3/)
Unspecified: 6/						
Actual	(3/)	(3/)	523	4,460	(3/)	(3/)
Estimated	3,460	21,800	731	4,290	--	--
Total	15,800	94,500	3,180	20,400	10,300	72,100
	District 7		District 8		District 9	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	1,150	8,670	5,160	26,900	7,600	36,900
Asphaltic concrete aggregates and other bituminous mixtures	--	--	1,120	6,120	2,870	15,300
Road base materials 4/	486	2,860	1,530	7,150	2,060	7,760
Other miscellaneous uses 5/	--	--	92	829	192	914
Unspecified: 6/						
Actual	913	6,940	70	348	3,740	17,100
Estimated	48	284	1,380	5,510	2,240	5,930
Total	2,600	18,700	9,350	46,800	18,700	84,000
	District 10		District 11		District 12	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	120	598	10,900	61,400	3,980	24,700
Asphaltic concrete aggregates and other bituminous mixtures	(3/)	(3/)	2,630	17,200	(3/)	(3/)
Road base materials 4/	288	998	1,290	4,690	1,150	3,960
Other miscellaneous uses 5/	(3/)	(3/)	(3/)	(3/)	--	--
Unspecified: 6/						
Actual	609	5,440	(3/)	(3/)	(3/)	(3/)
Estimated	585	3,360	1,670	6,650	3,580	19,300
Total	1,880	12,000	26,200	141,000	9,610	54,000

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Withheld to avoid disclosing company proprietary data; included in "Total."
4/ Includes fill, road and other stabilization (cement and lime), and snow and ice control.
5/ Includes filtration and railroad ballast.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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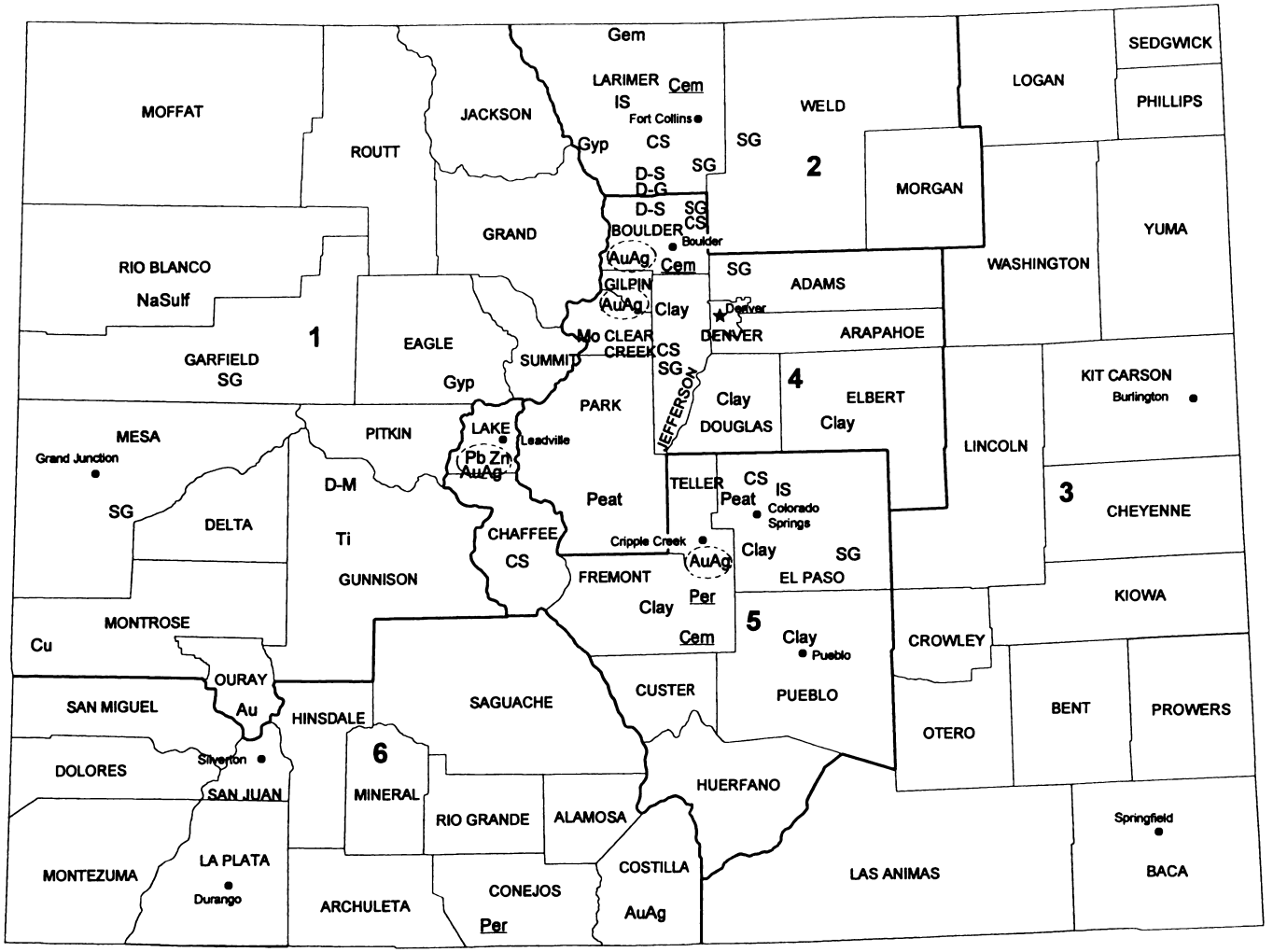
COLORADO



LEGEND

- State boundary
- County boundary
- ★ Capital
- ● City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

AuAg	Gold-silver
Cem	Cement plant
Clay	Clay
CS	Crushed stone
Cu	Copper
D-G	Dimension granite
D-M	Dimension marble
D-S	Dimension sandstone
Gem	Gemstones
Gyp	Gypsum
IS	Industrial sand
Mo	Molybdenum
NaSulf	Sodium sulfate
Pb	Lead
Peat	Peat
Per	Perlite plant
SG	Sand and gravel
Ti	Titanium
Zn	Zinc
⬭	Concentration of mineral operations

0 100 Kilometers

Source: Colorado Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF COLORADO

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Colorado Geological Survey for collecting information on all nonfuel minerals.

In 1997, Colorado climbed in rank to 24th from 25th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $536 million, about a 4.5% increase from that of 1996. This followed a 10% decrease from 1995 to 1996 (based on final 1996 data). The State accounted for nearly 1.5% of the U.S. total nonfuel mineral production value.

About 69% of Colorado's nonfuel mineral production value came from industrial minerals, especially construction sand and gravel, portland cement, and crushed stone, in descending order of value. Most of the State's remaining nonfuel mineral value resulted from the production of molybdenum, gold, and zinc. In 1997, a significant decrease in the production and value of gold was more than balanced out by the increases that occurred for zinc (up more than $13 million), construction sand and gravel, portland cement, and crushed stone. A $27 million decrease in the value of gold was the largest single decrease in the State's nonfuel mineral value in 1997; production was down 20%. All other nonfuel minerals increased in value except common clays, silver, lead, and peat, all of which slightly decreased. Bentonite and kaolin values remained the same.

In 1996, a $31 million increase in the value of gold, and smaller increases in crushed stone and portland cement, were mitigated by a significant decrease in the value of molybdenum together with smaller decreases for construction sand and gravel and zinc. A 54% decrease in molybdenum was the largest single decrease in nonfuel mineral value in 1996, resulting in the State's overall drop in value. The overall drop in value occurred because of average to relatively low prices for molybdic oxide throughout the year.

Compared with USGS estimates of the quantities produced in the other 49 States during 1997, Colorado remained second in molybdenum, fifth in grade-A helium, and sixth in zinc. The State was 8th of 13 gold-producing States, rose to 7th in gemstones (by value), and dropped from 10th to 11th in construction sand and gravel. Additionally, substantial quantities of portland cement and dimension stone were produced in the State.

The following narrative information was provided by the Colorado Geological Survey[2] (CGS). The precious metals industry in Colorado set a modern era (post-World War II) production record in 1996 of approximately 7,650 kilograms of gold and 9,700 kilograms of silver. Production estimates for 1997 showed a decline to 6,310 kilograms of gold because of the closure of Battle Mountain Gold Co.'s San Luis Gold Mine in San Luis, Costilla County, and the partial closure of ASARCO Incorporated's Black Cloud Mine in Leadville, Lake County.

In mineral exploration activities, Pikes Peak Mining Co. had continuing success with its aggressive precious metals exploration and development program in the Cripple Creek District, Teller County. Mineral exploration drilling continued in eastern Colorado for titanium resources in the Fox Hills Sandstone. Uranium exploration drilling was conducted near the Schwartzwalder Mine north of Golden and in western Colorado.

According to Pikes Peak Mining and the CGS, the Pikes Peak's Cresson Mine began production in February 1995. The mine had total proven and probable reserves of more than 66 million metric tons at a grade of 1.03 grams of gold per ton. In early 1997, mine management forecasted 1997 production of approximately 6,130 kilograms of gold and 840 kilograms of silver. The Cresson Mine employed about 275 persons in 1996 and 1997. Operating (cash) costs at the Cresson Mine are $197 per ounce of gold.

Base metal production in Colorado, excluding molybdenum, is minor. Asarco produced 816 tons per day of copper-lead-zinc-silver-gold ore from its Black Cloud Mine. The mine was reopened in March 1997 after a closure of about 6 months owing to a primary ball mill failure. Approximately 200 employees currently work at the mine and mill.

Cyprus Amax Mineral Co.'s Henderson Mine in Clear Creek County is the Nation's top producer of primary molybdic oxide. In 1997, an estimated 32 million pounds of molybdic oxide was produced at the mine and mill from about 6.35 million tons of ore, about the same as that of 1996. According to the company, the average realization per pound of molybdic oxide in 1997 was $5.59, which equals an estimated $179 million production value. Given stable economic conditions, the production forecast for 1998 was projected to again be 32 million pounds. Cyprus Amax reported that the Henderson Mine and mill employs 460 to 470 people with an annual average salary of $50,000.

The Henderson Mine has begun a modernization program called "Henderson 2000." At present, ore is hauled by an underground train system through a 15.3-kilometer tunnel under the Continental

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]James A. Cappa, Chief, Minerals and Mineral Fuels, authored the text of mineral industry information provided by the Colorado Geological Survey.

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Divide to the mill site. "Henderson 2000" includes replacement of the train system by a 16-kilometer underground conveyor belt system; ore crushing facilities will be moved from the surface at the mill to an underground site at the mine.

The aggregate industries did well in the Front Range metropolitan area from Colorado Springs to Fort Collins and in selected areas of western Colorado. The expected production of aggregate in 1997 was about 42.6 million metric tons, up 2.5% from the 1996 level of 41.5 million tons (*table 1*). The value of 1997 production was estimated at $209 million. Residential, school, and commercial construction and highway improvements were expected to result in continued increases in aggregate production.

Colorado Diamond Co., a subsidiary of Redaurum Red Lakes Mines Ltd. of Toronto, continued mining at its Kelsey Lake kimberlite prospect in the State Line District of Larimer County. The Kelsey Lake Mine is North America's only commercial diamond producer. Mine development has been based on a company reserve estimate of 16.9 million tons of ore, enough to last for 12 years of mining at the current rate. In April 1997, Redaurum acquired the Maxwell kimberlite about a mile west of the Kelsey Lake Mine. A bulk sampling program will be implemented to evaluate this prospect, probably starting in the first half of 1998.

The Kelsey Lake Mine continued production of exceptional gem-quality diamonds. In July 1997, two stones weighing 28.2 and 16.3 carats were recovered. Other exceptional stones included a 14.2 carat white diamond recovered during bulk sample testing in 1994 and a 28.3 carat yellow diamond unearthed in 1996. Redaurum expects the mine to produce about 25,000 carats in 1997. Plant upgrades were in progress to increase production. The usual percentage of gem-quality stone production at worldwide diamond mines is about 20% to 30%. To date about 65% of the recovered diamonds at Kelsey Lake have been gem quality.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN COLORADO 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Clays:							
Bentonite		(3/)	9	1	19	1	19
Common		288	2,040	317	2,320	283	1,860
Kaolin		6	W	6	W	6	W
Gemstones		NA	245	NA	754	NA	W
Sand and gravel, construction		34,100	141,000	31,600	133,000	32,400	139,000
Silver 4/	metric tons	W	W	7	1,240	W	W
Stone:							
Crushed		9,000	58,500	9,940	64,900	10,200	70,000
Dimension	metric tons	17,800	2,640	23,900	3,330	24,000	3,350
Combined value of cement, gold, gypsum (crude), helium (Grade-A), lead, lime, molybdenum, peat, sand and gravel (industrial), zinc, and values indicated by symbol W		XX	366,000	XX	308,000	XX	322,000
Total		XX	570,000	XX	513,000	XX	536,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Less than 1/2 unit.
4/ Recoverable content of ores, etc.

TABLE 2
COLORADO: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone	8	2,600	$15,300	$5.88	8	2,840	$15,200	$5.35
Granite	9	5,040	33,500	6.65	9	5,590	39,500	7.07
Sandstone	7	696	7,150	10.27	6	W	W	W
Traprock	1	W	W	3.54	1	204	W	W
Quartzite	1	W	W	5.80	1	W	W	6.54
Volcanic cinder and scoria	1	W	W	7.34 r/	1	W	W	7.53
Miscellaneous stone	2	W	W	6.68	3	W	W	6.29
Total	XX	9,000	58,500	6.50	XX	9,940	64,900	6.54

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits except unit values; may not add to totals shown.

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TABLE 3
COLORADO: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/ 3/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	465	$3,070	$6.60
Filter stone	2	9	4.50
Coarse aggregate, graded:			
Concrete aggregate, coarse	653	4,700	7.20
Bituminous aggregate, coarse	542	3,550	6.54
Bituminous surface treatment aggregate	18	67	3.72
Fine aggregate (-3/8 inch), stone sand, bituminous mix or seal 4/	598	2,030	3.39
Coarse and fine aggregates:			
Graded road base or subbase	532	2,810	5.28
Unpaved road surfacing	100	760	7.60
Terrazzo and exposed aggregate	W	W	7.41
Crusher run or fill or waste	378	722	1.91
Agricultural; poultry grit and mineral food	W	W	7.18
Chemical and metallurgical, cement manufacture	1,170	5,330	4.57
Unspecified: 5/			
Actual	3,320	27,200	8.19
Estimated	1,960	13,300	6.76
Total	9,940	64,900	6.54

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ To avoid disclosing company proprietary data; "District tables were not produced for 1996."
2/ Includes granite, limestone, miscellaneous stone, quartzite, sandstone, traprock, and volcanic cinder and scoria.
3/ Data are rounded to three significant digits; may not add to totals shown.
4/ Includes stone sand (concrete).
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 4
COLORADO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	6,670	$33,800	$5.07
Plaster and gunite sands	64	427	6.67
Concrete products (blocks, bricks, pipe, decorative, etc.)	277	1,770	6.40
Asphaltic concrete aggregates and other bituminous mixtures	2,840	12,900	4.54
Road base and coverings 2/	5,920	23,200	3.93
Fill	2,880	8,330	2.89
Snow and ice control	169	1,310	7.76
Other miscellaneous uses 3/	3,670	14,500	3.94
Unspecified: 4/			
Actual	1,890	7,850	4.15
Estimated	7,240	28,500	3.93
Total or average	31,600	133,000	4.19

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes filtration and railroad ballast.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 5
COLORADO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	786	5,520	758	3,780
Asphaltic concrete aggregates and road base materials 3/	3,610	14,800	2,210	7,900
Other miscellaneous uses 4/	891	3,380	(5/)	(5/)
Unspecified: 6/				
Actual	1,270	5,650	(5/)	(5/)
Estimated	675	2,070	963	3,560
Total	7,240	31,400	5,720	22,400
	District 3		District 4	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	135	753	3,550	17,700
Asphaltic concrete aggregates and road base materials 3/	509	1,410	3,180	11,500
Other miscellaneous uses 4/	--	--	689	2,720
Unspecified: 6/				
Actual	--	--	188	562
Estimated	140	247	3,530	14,600
Total	785	2,410	11,100	47,000
	District 5		District 6	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	1,490	6,760	287	1,510
Asphaltic concrete aggregates and road base materials 3/	1,340	4,950	949	5,280
Other miscellaneous uses 4/	483	1,930	(5/)	(5/)
Unspecified: 6/				
Actual	171	745	(5/)	(5/)
Estimated	1,160	4,830	773	3,170
Total	4,650	19,200	2,090	10,100

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Include fill, road and other stabilization (cement), and snow and ice control.
4/ Includes filtration and railroad ballast.
5/ Withheld to avoid disclosing company proprietary data; included in "Total."
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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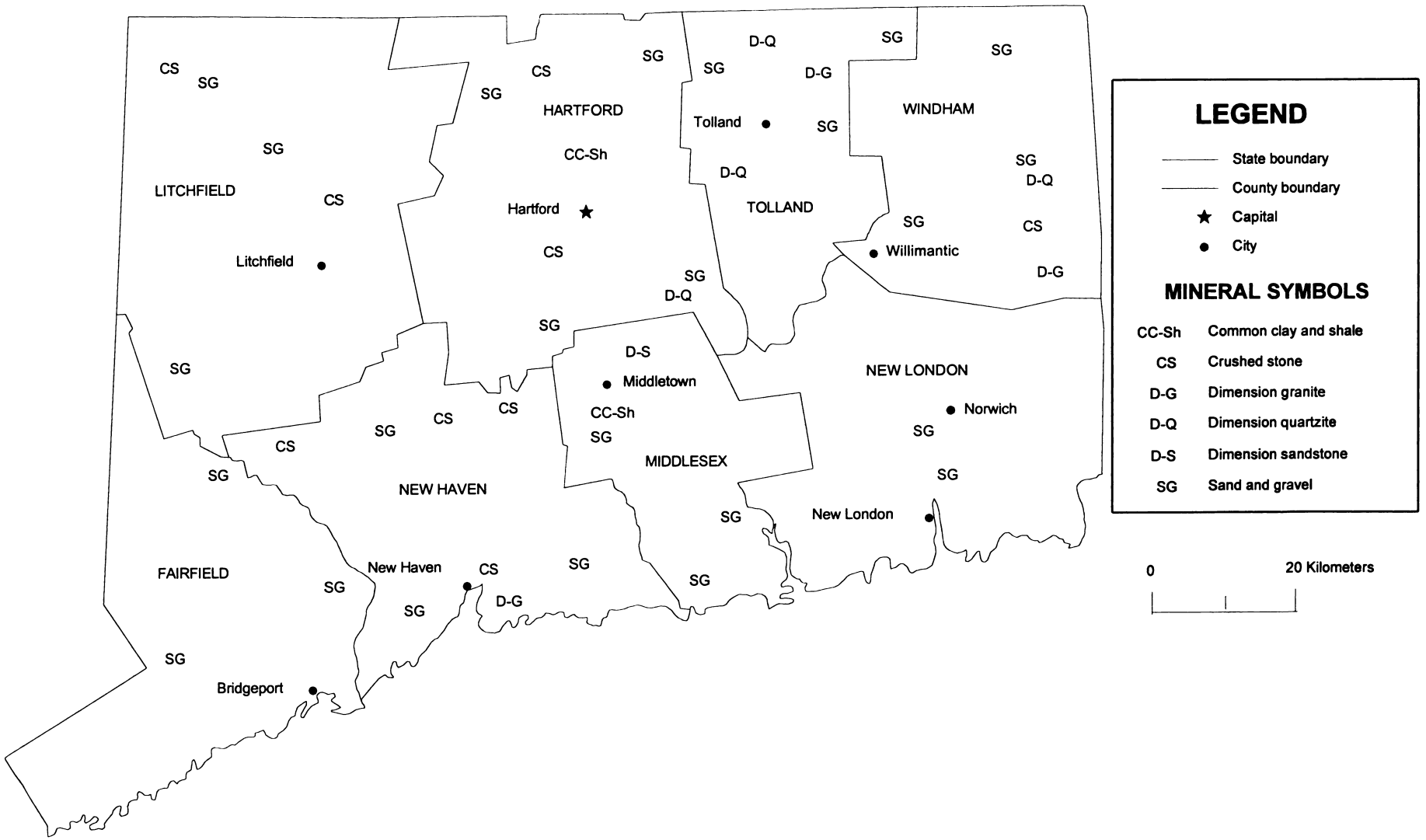
CONNECTICUT



Source: Connecticut Geological and Natural History Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF CONNECTICUT

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Connecticut Geological and Natural History Survey for collecting information on all nonfuel minerals.

In 1997, Connecticut ranked 46th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The State was 44th in 1996. The estimated value for 1997 was about $65 million, a 21% decrease from that of 1996. This followed an 11.5% decrease from 1995 to 1996 (based on final 1996 data). The State accounted for somewhat less than 0.5% of the U.S. total nonfuel mineral production value. Crushed stone and construction sand and gravel, the leading mineral commodities by value, accounted for nearly all of the State's total nonfuel mineral production and value. In 1997, the decrease in the production and value of crushed stone accounted for most of the State's drop in value. While the value of dimension stone showed a small increase, those of construction sand and gravel and common clays decreased slightly, and gemstones remained unchanged.

The following narrative information was provided by the Connecticut Geological and Natural History Survey.[2] Fairfield Resources Inc. received a renewal of its crushed stone mining permit for its quarry in the town of Brookfield, Fairfield County, in January 1997 from Brookfield's Planning and Zoning Commission. Nearly 6 months prior to this, in August 1996, Fairfield reached a settlement with the State Department of Environmental Protection in a 10-year-old dispute over environmental infractions, agreeing to pay a fine of $123,000 to the State and the Town of Brookfield. Residents had complained for years about drilling and blasting noise. Soneco Northeastern, Inc. proposed to open a new stone quarry in the City of Groton, New London County, and began the lengthy process of obtaining the necessary permits from the city.

The Roxbury Land Trust is trying to raise $70,000 to restore the granite tops of two old ovens at the Roxbury Iron Mine in Roxbury, Litchfield County. The mine operated sporadically from 1753 to 1872, first for silver, then iron, although never profitably. The ovens were used for roasting iron ore (siderite) before it was sent to the furnace at the site.

A proposal to open a museum of mining history in Connecticut is being acted upon by parties in the private sector. The collection of funds and artifacts proceeded during 1997.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. Construction sand and gravel and crushed stone estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/pubs/.

[2]Nancy McHone, Environmental Analyst, authored the text submitted by the Connecticut Geological and Natural History Survey.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN CONNECTICUT 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Gemstones	NA	5	NA	5	NA	5
Sand and gravel, construction	6,410	37,500	6,380	26,900	6,210	26,800
Stone, crushed	6,070 3/	45,500 3/	6,720	55,000	4,600	38,000
Combined value of other industrial minerals	XX	9,470	XX	(4/)	XX	(4/)
Total	XX	92,500	XX	81,900 5/	XX	64,800 5/

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined value" data.
4/ Value excluded to avoid disclosing company proprietary data.
5/ Partial total, excludes values that must be concealed to avoid disclosing company proprietary data.

TABLE 2
CONNECTICUT: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone	6	1,400	$10,600	$7.58	6	1,480	11,200	$7.55
Dolomite	(2/)	(2/)	(2/)	(2/)	1	W	W	W
Granite	6	172	1,530	8.88	6	144	1,110	7.70
Traprock	9	4,500	33,400	7.42	8	4,580	33,500	7.31
Quartzite	(2/)	(2/)	(2/)	(2/)	1	W	W	4.35
Miscellaneous stone	--	--	--	--	3	W	W	W
Total	XX	6,070	45,500	7.50	XX	6,720	55,000	8.19

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excludes dolomite and quartzite from State total to avoid disclosing company proprietary data.

TABLE 3
CONNECTICUT: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse and fine aggregates; other construction materials 3/	772	$7,080	$9.17
Agricultural, agricultural limestone	W	W	14.88
Special, other fillers or extenders	W	W	24.08
Unspecified: 4/			
Actual	1,520	11,900	7.78
Estimated	4,220	31,400	7.43
Total	6,720	55,000	8.19

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, granite, limestone, miscellaneous stone, quartzite, and traprock.
2/ Data are rounded to three significant digits except unit values; may not add to totals shown.
3/ Includes bituminous aggregate (coarse), concrete aggregate (coarse), graded roadbase or subbase, other coarse aggregate, other graded coarse aggregate, screening (undesignated), unpaved road surfacing, and terrazzo and exposed aggregate.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
CONNECTICUT: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products 2/	933	$6,020	$6.45
Asphaltic concrete aggregates and other bituminous mixtures	347	1,630	4.71
Road base and coverings	572	3,740	6.53
Fill	523	2,100	4.01
Snow and ice control	369	1,960	5.30
Other miscellaneous uses	2	7	3.50
Unspecified: 3/			
Actual	882	2,880	3.26
Estimated	2,750	8,540	3.11
Total or average	6,380	26,900	4.21

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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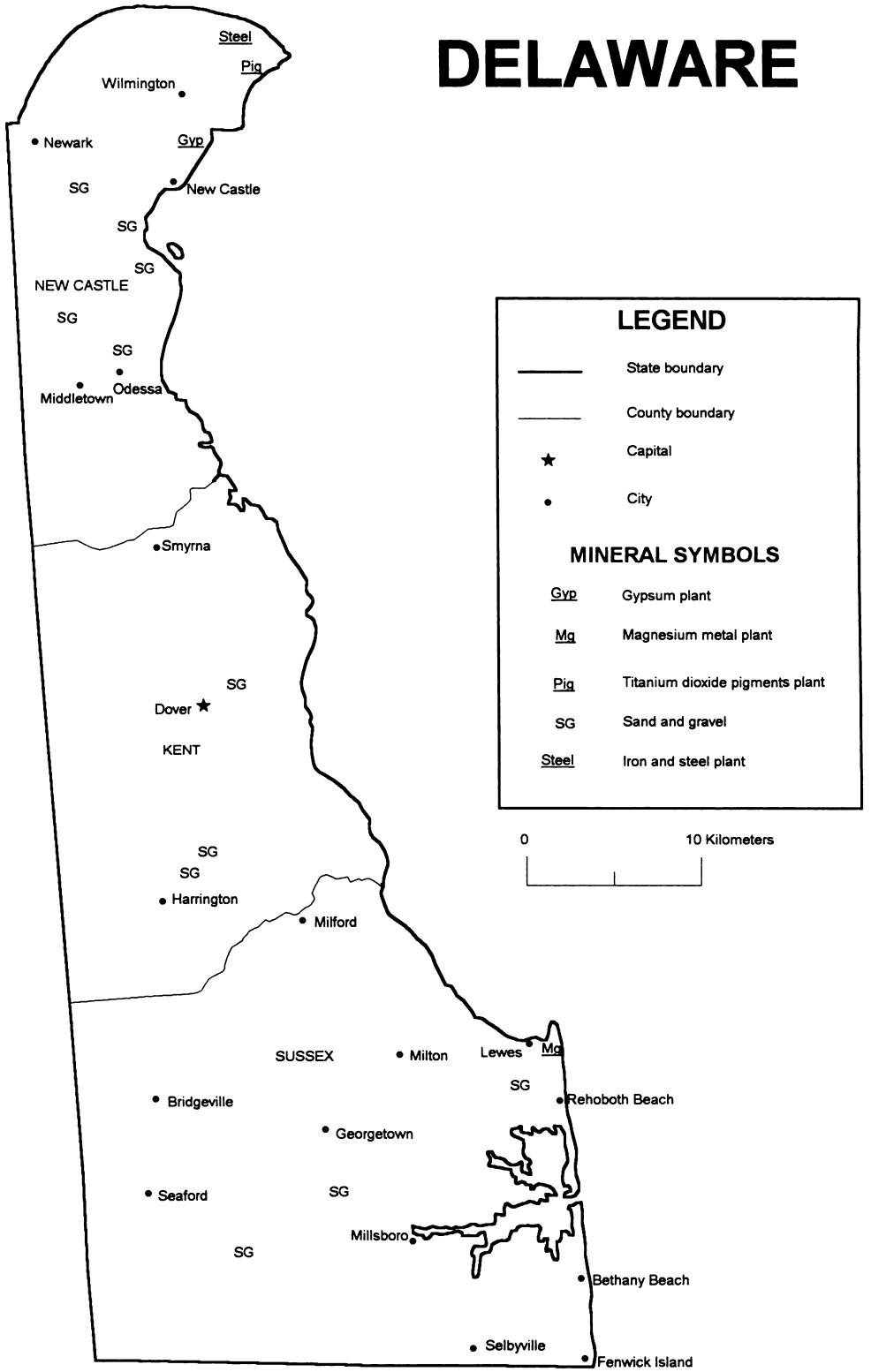
DELAWARE



Source: Delaware Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF DELAWARE

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Delaware Geological Survey for collecting information on all nonfuel minerals.

Delaware remained 50th in the Nation in total nonfuel mineral production value[1] in 1997, according to the U.S. Geological Survey (USGS); only construction sand and gravel and gemstones were mined. Delaware ranked fifth of the six States that produce magnesium compounds. Magnesium compounds were extracted from seawater close to the mouth of the Delaware Bay, near Lewes, Sussex County, for use in the manufacture of chemical and pharmaceutical products. Additionally, titanium-based pigments, raw steel, and gypsum-based wallboard were produced in the State but were processed from materials acquired from other domestic and foreign sources. The Delaware Geological Survey[2] (DGS) reported the expected completion of the digital portion of the State's topographic map project, a joint venture with the USGS. Delaware was the first State to have completely revised, modern topographic maps. The 1:24,000 quadrangle topographic maps (paper copies) became available in 1993. The hypsography layer became available in digital form in 1994 and is available on CD-ROM from the DGS. The remaining six digital layers were under development through 1997 and were on schedule to be made available from the DGS during the summer of 1998. The U.S. Department of the Interior's Minerals Management Service continued to provide support for studies characterizing offshore sand resources in both State and Federal waters for possible use in beach replenishment.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. Construction sand and gravel estimates are updated periodically. To obtain the most current information, please contact the USGS sand and gravel specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at: http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http:// minerals.er.usgs.gov/minerals/pubs/.

[2] John H. Talley, Associate Director of the DGS, authored the text of State minerals information provided by the Delaware Geological Survey.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN DELAWARE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Gemstones	NA	1	NA	1	NA	1
Sand and gravel, construction	2,680	8,740	2,370	6,820	2,200	6,490
Total 3/	XX	8,750	XX	6,820	XX	6,490

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Partial total, excludes values which must be concealed to avoid disclosing company proprietary data.

TABLE 2
DELAWARE: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Fill	1,180	$3,890	$3.30
Unspecified: 2/			
Actual	63	159	2.52
Estimated	1,120	2,770	2.46
Total or average	2,370	6,820	2.88

1/ Data are rounded to three significant digits.
2/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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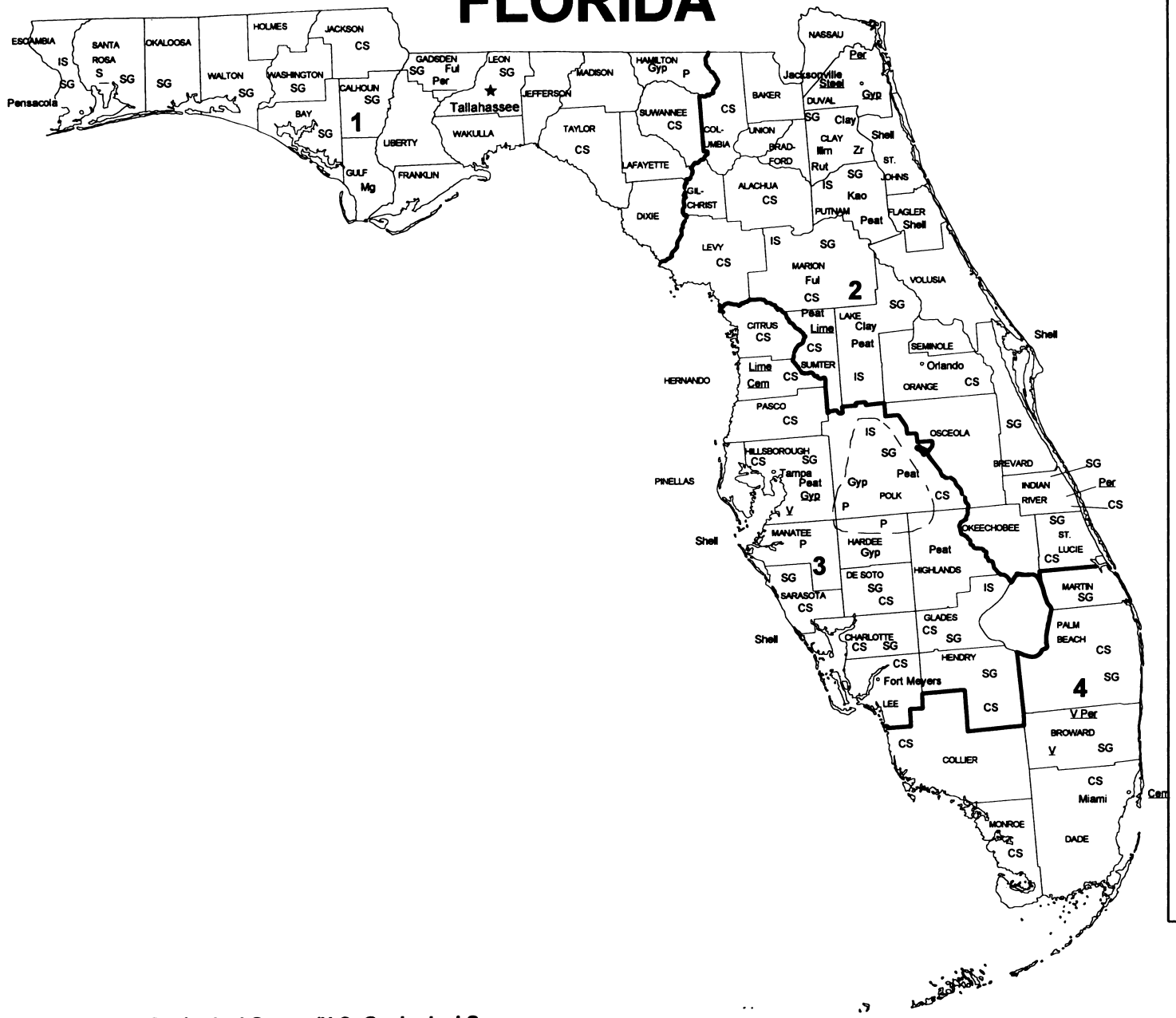
FLORIDA



LEGEND

- State boundary
- County boundary
- ★ Capital
- • City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Cem	Cement plant
Clay	Common clay
CS	Crushed stone
Ful	Fuller's earth
Gyp	By product gypsum
Gyp	Gypsum plant
Illm	Illmenite
Kao	Kaolin
Lime	Lime plant
Mg	Magnesium
P	Phosphate rock
Peat	Peat
Per	Perlite plant
Rut	Rutile
SG	Sand and gravel
IS	Industrial sand
Shell	Shell
Steel	Steel plant
S	Sulfur plant
V	Vermiculite plant
Zr	Zircon

Concentration of mineral operations

0 100 Kilometers

Source: Florida Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF FLORIDA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Florida Geological Survey for collecting information on all nonfuel minerals.

Florida ranked sixth among the 50 States in total nonfuel mineral production value[1] in 1997, according to the U.S. Geological Survey (USGS). The State was fourth in 1996. The estimated value for 1997 was more than $1.7 billion, a 1% decrease from that of 1996. This followed a 14% increase from 1995 to 1996 (based on final 1996 data). The State accounted for almost 4.5% of the U.S. total nonfuel mineral production value.

Florida continued to be the Nation's leading phosphate rock-mining State in 1997, producing more than five times the quantity of material as that of the next-highest State. Phosphate rock is only produced in four States. In terms of value, phosphate rock, crushed stone, and portland cement continued to be the most important minerals produced in Florida. In 1997, significant increases in the values of portland cement, construction sand and gravel, and phosphate rock moderated but did not overcome decreases in fuller's earth and crushed stone (*table 1*), resulting in the State's small drop in nonfuel mineral value from that of 1996. In 1996, most of the State's nonfuel mineral commodities increased in value, led by phosphate rock, which increased nearly 18% (more than $100 million), compared with that of 1995. The other leading nonfuel mineral commodities in 1996, in descending order of net increase, were crushed stone, zircon concentrates, portland cement, ilmenite, fuller's earth, and rutile. Only construction sand and gravel showed a small decrease.

Based on USGS estimates of quantities produced in the 50 States during 1997, Florida remained the only State to produce zircon concentrates, rutile, and staurolite; first in peat and masonry cement, first of 2 ilmenite-producing States (as well as the major U.S. producer), and seventh in portland cement. The State rose to second from third in fuller's earth, to third from fourth in magnesium compounds, and dropped from third to fourth in crushed stone. Additionally, Florida produced significant quantities of construction sand and gravel.

The following narrative information was provided by the Florida Geological Survey[2] (FGS). Common clay is extracted in small quantities from many localities in Florida. Kaolin is mined in Putnam County at the Feldspar Corp. Mine. Fuller's earth, in the form of attapulgite (palygorskite), is extracted in the Gadsden County area of northwest Florida and montmorillonite-type fuller's earth in north-central Florida in Marion County. The attapulgite-type fuller's earth is most often recognized as Florida's primary clay commodity. During the past year the Engelhard Corp. purchased the Floridin Co. and is operating the Quincy Mine, which was formerly operated by Floridin.

Heavy minerals produced in Florida are used in the manufacture of titanium dioxide pigments. RGC (USA) Mineral Sands, Inc. (RGC), and E.I. du Pont de Nemours & Co. Inc., are the only heavy mineral producers in the State. This past year, RGC received an Environmental Resource Permit (ERP) for a satellite mine. RGC will conduct operations without the use of a suction dredge and a floating wet-mill concentrator, and instead will use traditional earth-moving equipment. The sand will be concentrated at a land-based concentrator at the mine site.

Florida's phosphate operations supply approximately 25% of the world's and 75% of the Nation's phosphate needs. Phosphate rock is the State's largest industrial mineral commodity in terms of quantity mined and value. Companies presently mining in Florida include IMC-Agrico Co., Cargill Fertilizer, Inc., CF Industries, Inc., Potash Corp. of Saskatchewan (PSC), and Agrifos L.L.C. Neither Farmland Industries, Inc. nor Nu-Gulf Industries were actively mined in 1997; however, Farmland is just about to enter into the permitting phase for a new mine. IMC-Agrico also is working on permits for two new mines, permits must be obtained before any mining is allowed.

Limestone, the primary source of stone, is mined in many localities in the State. During the past year, Florida Rock Industries, Inc. (FRI) acquired permission to mine at the Florida Aggregates Inter-Group Mine in St. Lucie County. FRI is now in the process of getting the proper permits. Construction has begun on FRI's new cement mill in western Alachua County. It is anticipated that the mill will be brought on-line in 18 months.

Florida Limerock and Aggregates Institute (FLAI), which acts as the voice of the Florida aggregate industry, continues to work closely with the Florida Department of Transportation as they implement both "Superpave," a new asphalt mix design concept, and Quality Control 2000, a quality control/quality assurance program to improve the quality of construction for the State and federal highway system. Many of the aggregate producers are members of the FLAI.

The Department of Environmental Protection's (DEP) Bureau

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at: http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Steven Spencer, Coastal/Economic Geologist, authored the text submitted by the Florida Geological Survey.

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of Mine Regulation (BOMR) administers the State's reclamation rules. The rules, which are spelled out in the Florida Administrative Code, give the BOMR authority to regulate individual operators in their reclamation efforts. There is no statewide mining law covering all commodities.

The BOMR transferred the ERP and reclamation programs for mines within the Southwest district to the DEP Southwest District Office. These programs cover clay, limestone, peat, sand and gravel, and shell and dolomite operations. The only mines in the district that are still under the jurisdiction of BOMR are those mines where operators have other mines in other DEP districts or, where their mines cross into neighboring districts.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN FLORIDA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Cement:						
Masonry	383	35,200	422	35,200 e/	431	36,600 e/
Portland	3,170	233,000	3,450	245,000 e/	3,510	255,000 e/
Clays:						
Fuller's earth	388	50,800	377	58,900	430	41,900
Kaolin	33	3,510	35	3,760	35	3,770
Gemstones	NA	W	NA	1	NA	1
Peat	294	5,390	298	5,550	244	4,690
Sand and gravel:						
Construction	19,300	69,300	18,500	68,800	19,300	73,500
Industrial	547	6,340	515	6,340	515	6,330
Stone, crushed	68,000	350,000	73,600 3/	394,000 3/	70,200 3/	380,000 3/
Combined value of clays (common), magnesium compounds, phosphate rock, staurolite, stone [crushed marl (1996-97)], titanium concentrates, zirconium concentrates, and value indicated by symbol W	XX	783,000	XX	947,000	XX	943,000
Total	XX	1,540,000	XX	1,760,000	XX	1,740,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined value" data.

TABLE 2
FLORIDA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone	75 r/	64,200 r/	$329,000 r/	$5.12 r/	76 2/	71,000 2/	$379,000 2/	$5.34 2/
Limestone-dolomite	2	W	W	7.06	--	--	--	--
Dolomite	4	1,120	7,010	6.28	4	W	W	6.55
Shell	5	1,090	4,100	3.78	4	W	W	4.46
Calcareous marl	2	W	W	4.53	(3/)	(3/)	(3/)	(3/)
Total	XX	68,000	350,000	5.14	XX	73,600	394,000	5.35

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes "Limestone-dolomite," reported with no distinction between the two.
3/ Excludes calcareous marl from State total to avoid disclosing company proprietary data.

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TABLE 3
FLORIDA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	274	$1,620	$5.89
Filter stone	361	1,900	5.26
Coarse aggregate, graded:			
Concrete aggregate, coarse	12,400	86,800	7.02
Bituminous aggregate, coarse	5,580	36,500	6.54
Bituminous surface-treatment aggregate	309	2,650	8.59
Other graded coarse aggregate 3/	994	6,530	6.57
Fine aggregate (-3/8 inch):			
Stone sand, concrete	6,080	42,900	7.04
Stone sand, bituminous mix or seal	3,120	19,300	6.18
Screening, undesignated	2,600	9,630	3.70
Other fine aggregates	1,330	7,480	5.64
Coarse and fine aggregates:			
Graded road base or subbase	17,100	67,500	3.94
Unpaved road surfacing	420	1,860	4.43
Crusher run or fill or waste	4,300	15,700	3.67
Other coarse and fine aggregates	2,040	6,080	2.98
Other construction materials 4/	284	1,320	4.64
Agricultural limestone 5/	816	4,600	5.63
Chemical and metallurgical, cement manufacture	3,220	9,160	2.84
Special:			
Other fillers or extenders	W	W	5.51
Other specified uses not listed	W	W	9.06
Unspecified: 6/			
Actual	8,050	48,100	5.98
Estimated	4,360	24,000	5.51
Total	73,600	394,000	5.35

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, limestone, limestone-dolomite, and shell; excludes calcareous marl from State to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes railroad ballast.
4/ Includes pipe bedding.
5/ Includes poultry grit and mineral food and other agricultural uses.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4

FLORIDA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE AND DISTRICT 1/ 2/ 3/

(Thousand metric tons and thousand dollars)

Use	District 3		District 4	
	Quantity	Value	Quantity	Value
Construction aggregates:				
Coarse aggregate (+1 1/2 inch) 4/	99	727	536	2,790
Coarse aggregate, graded 5/	5,570	40,400	13,700	92,100
Fine aggregate (-3/8 inch) 6/	3,930	19,400	9,200	59,800
Coarse and fine aggregate 7/	10,700	36,100	13,200	55,000
Other construction materials 8/	75	738	209	579
Agricultural 9/	816	4,600	--	--
Chemical and metallurgical 10/	W	W	W	W
Special 11/	W	W	--	--
Other miscellaneous uses 12/	W	W	--	--
Unspecified: 13/				
Actual	W	W	W	W
Estimated	2,260	12,900	2,090	11,200
Total	31,800	159,000	41,800	235,000

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Excludes calcareous marl from State total to avoid disclosing company proprietary data.
2/ Production reported in District 1 and District 2 was included with "District 3" to avoid disclosing company proprietary data.
3/ Data are rounded to three significant digits; may not add to totals shown.
4/ Includes filter stone and riprap and jetty stone.
5/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
6/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
7/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
8/ Includes pipe bedding.
9/ Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.
10/ Includes cement manufacture.
11/ Includes other fillers or extenders.
12/ Includes other specified uses not listed.
13/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5

FLORIDA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996, BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	7,410	$30,900	$4.17
Plaster and gunite sands	694	2,480	3.57
Concrete products (blocks, bricks, pipe, decorative, etc.)	529	2,630	4.97
Asphaltic concrete aggregates and other bituminous mixtures	405	1,400	3.46
Road base and coverings 2/	793	4,740	5.97
Fill	1,930	3,390	1.76
Other miscellaneous uses 3/	520	2,160	4.15
Unspecified: 4/			
Actual	2,150	9,260	4.30
Estimated	4,050	11,800	2.91
Total or average	18,500	68,800	3.72

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes fill and road and other stabilization (cement and lime).
3/ Includes filtration.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
FLORIDA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	952	3,340	W	W	W	W	254	560
Asphaltic concrete aggregates and road base materials 3/	871	1,360	W	W	W	W	373	551
Other miscellaneous uses 4/	4	8	7,220	32,400	2,600	9,570	--	--
Unspecified: 5/								
Actual	246	2,290	--	--	1,910	6,970	--	--
Estimated	807	2,400	1,520	4,620	1,020	3,300	711	1,460
Total	2,880	9,400	8,740	37,000	5,520	19,800	1,340	2,570

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill and road and other stabilization (cement and lime).
4/ Includes filtration.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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Source: Georgia Geologic Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF GEORGIA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Georgia Geologic Survey for collecting information on all nonfuel minerals.

Georgia increased in rank from fifth to fourth nationally in total nonfuel mineral production value[1] in 1997, according to the U.S. Geological Survey (USGS). The estimated value in 1997 was $1.77 billion, a 2% increase from that of 1996. This followed about a 3% increase from 1995 to 1996 (based on final 1996 data). The State accounted for 4.5% of the U.S. total nonfuel mineral production value.

Georgia was by far the leading clay-producing State in the Nation, accounting for nearly 24% of U.S. total clay production. Kaolin remained Georgia's foremost nonfuel mineral commodity in 1997, accounting for 59% of the State's estimated total nonfuel mineral value and of that about 92% of its clay value. Whereas kaolin production was down 4% for the year, its value remained the same.

In 1997, nearly all other nonfuel mineral commodities increased in value, led by a $24 million, or 6%, increase in the value of crushed stone. Crushed stone accounted for 24% of the State's nonfuel mineral production value. While portland cement increased by 4% in value, fuller's earth dropped off by about the same. In the previous year, 1996, the most significant increases in final values occurred in crushed stone and portland cement; these were somewhat moderated by a decrease in kaolin (*table 1*).

Based on USGS estimates of the quantities produced in the United States during 1997, Georgia remained first among the 50 States in kaolin and fuller's earth, second in barite, third in iron oxide pigments, fourth in dimension stone and feldspar, fifth in common clays, and eighth in masonry cement. While Georgia rose from fifth to third in crude mica, the State dropped from sixth to eighth in crushed stone.

The following narrative information was provided by the Georgia Geologic Survey,[2] in cooperation with representatives of the Georgia Crushed Stone Association (GCSA) and the Elberton Granite Association. The GCSA includes all major producers in Georgia.

The GCSA reported that their quarries shipped an estimated 62.1 million metric tons of crushed stone in 1997. This represented a 5% increase in production from that of 1996. Thus, in spite of some previous predictions, there was no drop-off following the 1996 Olympics in Atlanta. According to the GCSA, future prospects in the crushed stone industry ranged from little change to continued growth in 1998. This was dependent upon several factors, especially the level of funding for highway construction in the next Federal Budget. The counties in the Atlanta metropolitan area have had continued air quality problems—particularly for exceeding ozone limits. If these problems are not properly addressed, the result could be severe reductions in Federal highway funding in the near future. Additionally, new national standards to increase the proportion of coarse stone in asphalt mix are planned in July 1998. This would effectively increase Georgia's crushed stone internal demand by about 20%, which could cause the crushed stone industry in Georgia to have difficulty in meeting future demand for crushed stone.

Georgia's dimension granite industry includes operations in Elbert, Oglethorpe, Madison, Greene, and Wilkes Counties; however, most quarries and plants are in Elbert County. During 1997, there were 45 active quarries producing more than 57,000 cubic meters of monumental-grade granite. The industry employs approximately 2,100 individuals with a quarry workforce of 323 production workers. In 1996-97, the total industry payroll was $52 million while the quarry payroll was $6.7 million. Local sales of granite remained strong in 1997; however, sales to Pacific Rim markets continued to decline. On the other hand, there is growing interest from some European buyers, but the volume is not significant.

In June 1997, the Rock of Ages Corp. of Barre, VT, announced its merger with Keystone Memorials Co. of Elberton and the purchase of two other Elberton firms—Childs & Childs Granite Co., Inc. and Southern Mausoleums, Inc. This transaction involved quarries in Georgia, North Carolina, South Carolina, Oklahoma, and Pennsylvania.

In order to address the continuing shortage of semiskilled and skilled labor, the dimension granite industry planned to initiate a pilot program with area social service departments in 1998 to train women in various plant production jobs. In addition, the industry is sponsoring a training program that will reimburse employers for a portion of the wages of employees enrolled in stone-cutting apprentice positions.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html.

[2]Bruce J. O'Connor, Supervisory Geologist, authored the text of mineral industry information submitted by the Georgia Geologic Survey.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN GEORGIA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Clays:						
Common	1,660	11,200	1,660	11,200	1,890	11,600
Fuller's earth	744	90,100	739	89,200	739	85,000
Kaolin	8,240	1,060,000	8,040	1,050,000	7,690	1,050,000
Gemstones	NA	51	NA	32	NA	594
Sand and gravel:						
Construction	5,780	23,100	6,520	24,500	6,370	24,500
Industrial	574	7,060	313	5,650	314	6,230
Stone:						
Crushed	60,600	373,000	63,400 3/	401,000 3/	65,000 3/	425,000 3/
Dimension metric tons	132,000	27,700	89,600 3/	10,300 3/	90,100 3/	10,400 3/
Combined value of barite, bauxite (1995), cement, feldspar, iron oxide pigments (crude), mica (crude), and stone [crushed marble (1996-97), dimension marble (1996-97)], and talc and pyrophyllite (1997)	XX	102,000	XX	148,000	XX	154,000
Total	XX	1,690,000	XX	1,740,000	XX	1,770,000

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined value" data.

TABLE 2
GEORGIA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone 2/	17 r/	8,330 r/	$50,200 r/	$6.02	r/ 20	10,100	$65,600	$6.48
Marble	7	W	W	7.54	r/ (3/)	(3/)	(3/)	(3/)
Granite	51	51,300	315,000	6.14	r/ 51	53,300	336,000	6.31
Quartzite	1	W	W	7.17	r/ --	--	--	--
Total	XX	60,600	373,000	6.14	XX	63,400	401,000	6.33

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes "Limestone-dolomite," reported with no distinction between the two.
3/ Excludes marble from State total to avoid disclosing company proprietary data.

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TABLE 3
GEORGIA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	W	W	$8.49
Riprap and jetty stone	471	$4,770	10.12
Filter stone	534	4,250	7.96
Coarse aggregate, graded:			
Concrete aggregate, coarse	5,310	33,600	6.32
Bituminous aggregate, coarse	3,310	24,400	7.37
Other graded coarse aggregate 3/	4,420	32,500	7.36
Fine aggregate (-3/8 inch):			
Stone sand, concrete	1,880	11,700	6.22
Stone sand, bituminous mix or seal	3,630	19,300	5.32
Screening, undesignated	512	2,940	5.74
Other fine aggregate	W	W	3.73
Coarse and fine aggregates:			
Graded road base or subbase	3,440	18,100	5.28
Unpaved road surfacing	118	664	5.63
Terrazzo and exposed aggregate	W	W	6.43
Crusher run or fill or waste	6,250	35,200	5.63
Other construction materials 4/	463	2,860	6.17
Agricultural limestone:	13	92	7.08
Chemical and metallurgical, cement manufacture	(5/)	(5/)	5.17
Special, whiting or whiting substitute	(5/)	(5/)	11.00
Unspecified: 6/			
Actual	29,100	186,000	6.40
Estimated	1,790	11,400	6.40
Total	63,400	401,000	6.33

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Includes, granite, limestone, limestone-dolomite, and quartzite; excludes marble from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits except unit values; may not add to totals shown.
3/ Includes bituminous aggregate (coarse) and railroad ballast.
4/ Includes drain fields.
5/ Withheld to avoid disclosing company proprietary data; included in "Total."
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
GEORGIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	192	1,540	W	W	W	W
Coarse aggregate, graded 4/	2,760	18,700	W	W	W	W
Fine aggregate (-3/8 inch) 5/	911	5,970	W	W	W	W
Coarse and fine aggregate 6/	2,210	13,500	W	W	W	W
Other construction materials 7/	23	138	22,100	140,000	2,080	10,800
Agricultural 8/	13	92	--	--	--	--
Chemical and metallurgical 9/	(10/)	(10/)	--	--	(10/)	(10/)
Special 11/	(10/)	(10/)	--	--	--	--
Unspecified: 12/			--	--		
Actual	(10/)	(10/)	7,920	45,800	(10/)	(10/)
Estimated	1,650	10,500	--	--	138	891
Total	19,200	128,000	30,100	185,000	14,100	88,100

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Excludes marble from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, and riprap and jetty stone.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, and crusher run (select material or fill).
7/ Includes drain fields.
8/ Includes agricultural limestone.
9/ Includes cement and lime manufacture.
10/ Withheld to avoid disclosing company proprietary data; included in "Total."
11/ Includes whiting or whiting substitute.
12/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
GEORGIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	3,220	$12,200	$3.78
Plaster and gunite sands	630	2,160	3.43
Concrete products (blocks, bricks, pipe, decorative, etc.)	178	565	3.17
Asphaltic concrete aggregates and other bituminous mixtures	W	W	15.83
Fill	W	W	2.07
Other miscellaneous uses	148	698	4.72
Unspecified: 2/			
Actual	1,020	3,940	3.85
Estimated	1,320	4,950	3.75
Total or average	6,520	24,500	3.75

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
1/ Data are rounded to three significant digits except value per ton; may not add to totals shown.
2/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
GEORGIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 2		District 3	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	565	3,020	3,470	11,900
Other miscellaneous uses 4/	10	47	139	651
Unspecified: 5/				
Actual	388	1,430	635	2,510
Estimated	206	771	1,110	4,170
Total	1,170	5,260	5,350	19,200

1/ Production reported in District 1 was included with "District 2" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Includes asphaltic concrete aggregates and other bituminous mixtures and fill.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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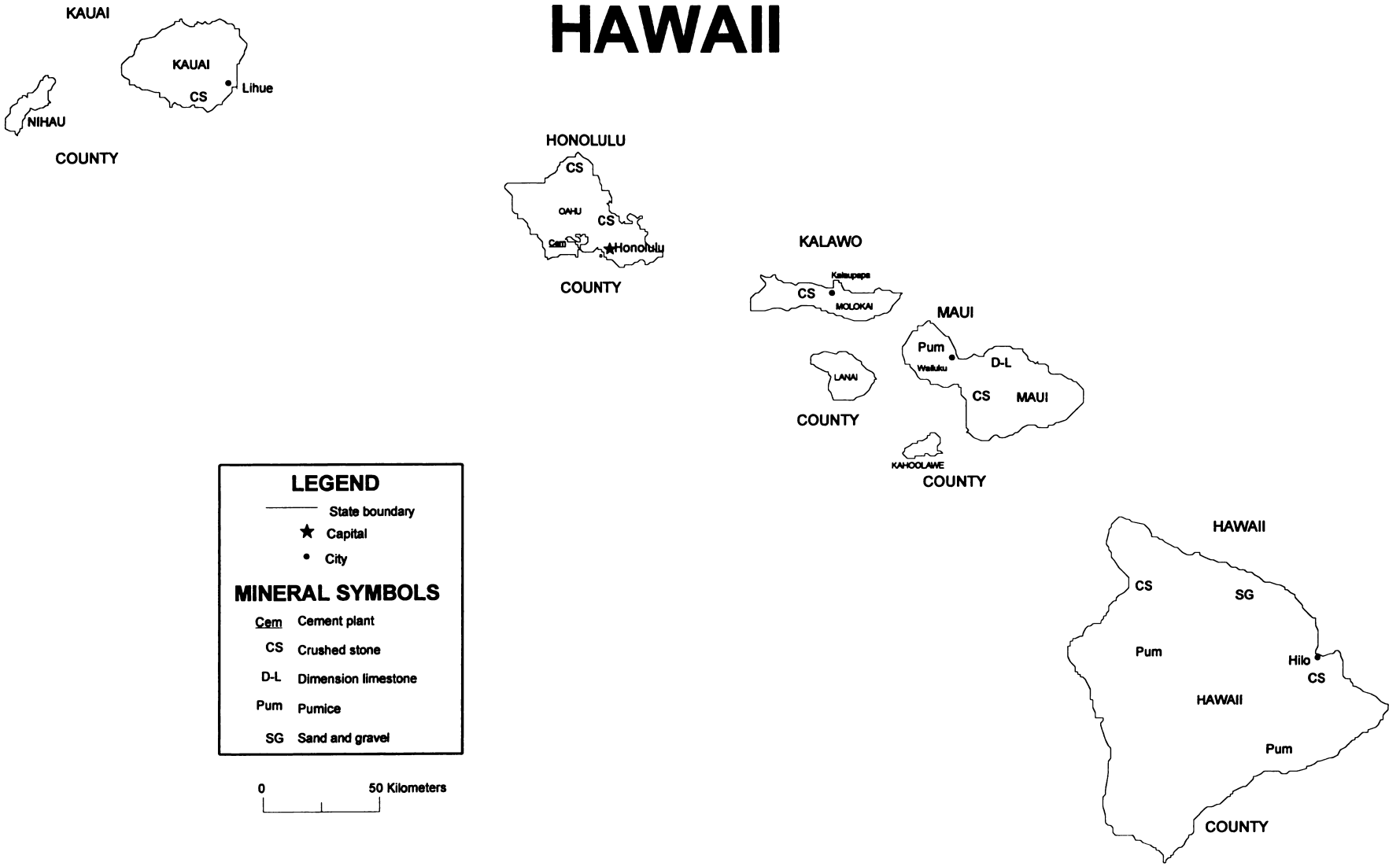
HAWAII



Source: Hawaii Division of Water and Land Development/U.S. Geological Survey

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THE MINERAL INDUSTRY OF HAWAII

In 1997, for the fourth consecutive year, Hawaii remained 43d among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was nearly $100 million, about a 9% decrease from that of 1996. This followed a 3.5% decrease from 1995 to 1996 (based on final 1996 data). The State accounted for somewhat less than 0.5% of the U.S. total nonfuel mineral production value.

Mining in Hawaii consisted mostly of the quarrying of stone to produce crushed stone and the extraction of sand and gravel from open pits, both for use by the State's construction industry. All of the State's portland cement, albeit from imported clinker, was produced at one grinding plant on the island of Oahu, Honolulu County. Hawaii's decrease in the value of nonfuel mineral production in 1997 is mostly attributable to a decrease in the value of crushed stone. Although the estimated value of portland cement increased by almost 4%, or about $1.2 million *(table 1)*, and construction sand and gravel increased by about 7%, crushed stone value decreased by 15%, or about $11.5 million. Both crushed stone and portland cement have shown an overall decrease in value since both reached individual State highs in 1992. In 1992, about 9.5 million metric tons of crushed stone were produced at an estimated value of $93.5 million and 520,000 tons of portland cement were produced at a value of almost $54 million.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN HAWAII 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Cement:						
Masonry	5	501	5	500 e/	5	520 e/
Portland	357	35,500	312	32,000 e/	318	33,200 e/
Gemstones	NA	W	NA	153	NA	129
Sand and gravel, construction	405	4,030	W	W	W	W
Stone, crushed	7,450 3/	73,500 3/	6,560	77,500	5,500	66,000
Total 4/	XX	114,000	XX	110,000	XX	99,900

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; data excluded to avoid disclosing company proprietary data.
4/ Partial total, excludes values that must be concealed to avoid disclosing company proprietary data.

TABLE 2
HAWAII: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone	7	1,190	$10,300	$8.64	6	1,030	$10,500	$10.22
Granite	--	--	-	--	1	W	W	8.30
Traprock	22	6,230	63,100	10.12	17	4,220	55,100	13.06
Sandstone	(2/)	(2/)	(2/)	(2/)	1	W	W	10.53
Volcanic cinder and scoria	4	29	166	5.72	2	W	W	2.94
Miscellaneous stone	(2/)	(2/)	(2/)	(2/)	1	W	W	11.30
Total	XX	7,450 3/	73,500 3/	9.87	XX	6,560	77,500	11.82

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits except unit values; may not add to totals shown.
2/ Excludes miscellaneous stone and sandstone from State total to avoid disclosing company proprietary data.
3/ Excludes certain stones; data excluded to avoid disclosing company proprietary data.

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TABLE 3
HAWAII: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	16	$256	$16.00
Filter stone	87	1,170	13.43
Other coarse aggregate 3/	151	1,620	10.74
Coarse aggregate, graded:			
Concrete aggregate, coarse	1,830	26,600	14.51
Bituminous aggregate, coarse	200	2,050	10.25
Bituminous surface-treatment aggregate	115	1,580	13.74
Other graded coarse aggregate	W	W	12.00
Fine aggregate (-3/8 inch):			
Stone sand, concrete	860	12,800	14.94
Stone sand, bituminous mix or seal	284	2,470	8.68
Screening, undesignated	2	26	13.00
Coarse and fine aggregates:			
Graded road base or subbase	1,010	11,400	11.31
Unpaved road surfacing		W	2.39
Crusher run or fill or waste	706	5,880	8.32
Other construction materials 4/	40	363	9.08
Agricultural limestone	(5/)	(5/)	7.10
Chemical and metallurgical, cement manufacture	162	1,440	8.86
Unspecified: 6/			
Actual	(5/)	(5/)	14.45
Estimated	990	8,600	8.69
Total	6,560	77,500	11.82

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Includes granite, limestone, miscellaneous stone, sandstone, traprock, and volcanic cinder and scoria.
2/ Data are rounded to three significant digits except unit value; may not add to totals shown.
3/ Includes macadam.
4/ Includes roofing granules.
5/ Withheld to avoid disclosing company proprietary data; included in "Total."
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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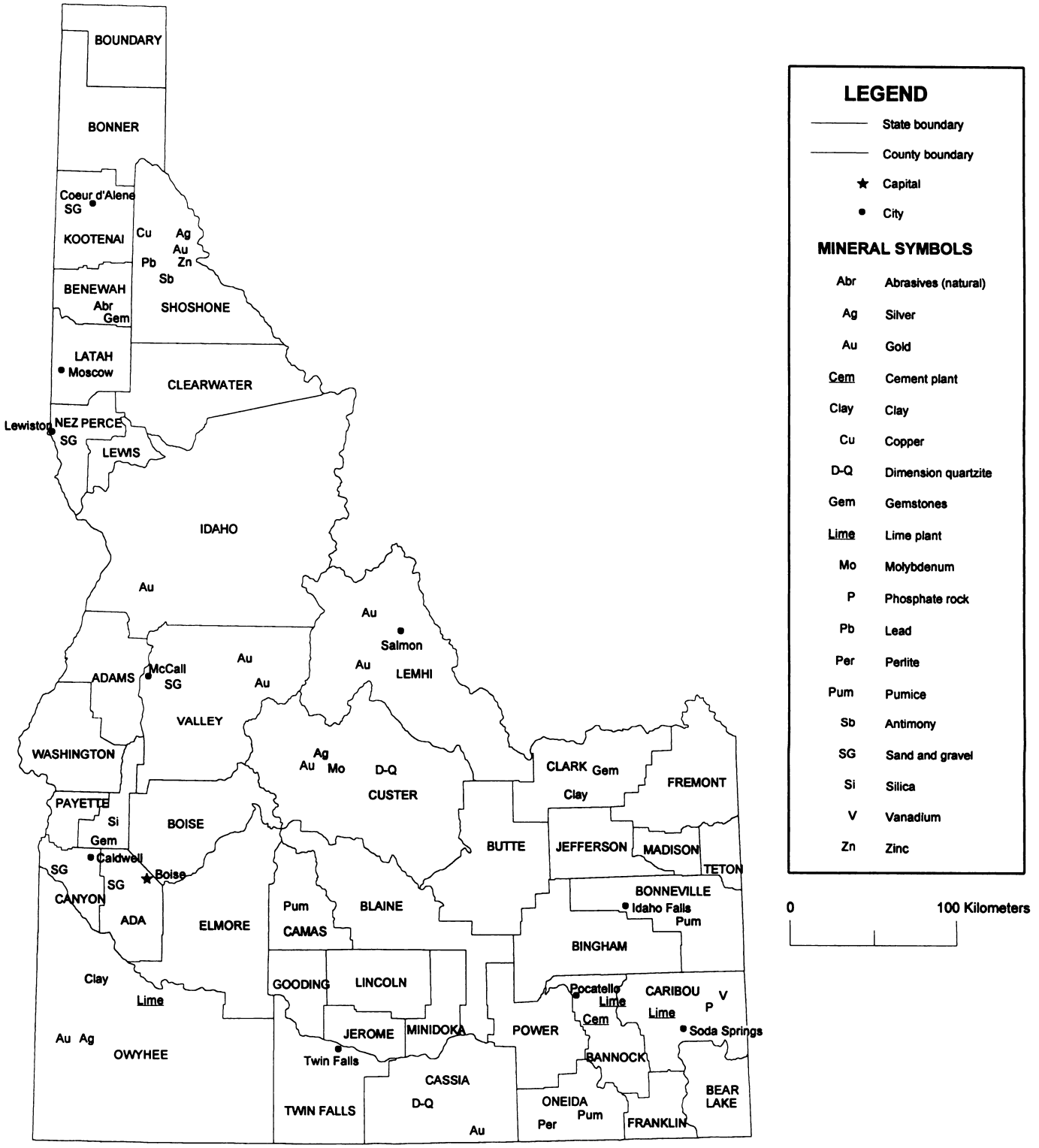
IDAHO



LEGEND

- State boundary
- County boundary
- ★ Capital
- • City

MINERAL SYMBOLS

Abr	Abrasives (natural)
Ag	Silver
Au	Gold
Cem	Cement plant
Clay	Clay
Cu	Copper
D-Q	Dimension quartzite
Gem	Gemstones
Lime	Lime plant
Mo	Molybdenum
P	Phosphate rock
Pb	Lead
Per	Perlite
Pum	Pumice
Sb	Antimony
SG	Sand and gravel
Si	Silica
V	Vanadium
Zn	Zinc

0 100 Kilometers

Source: Idaho Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF IDAHO

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Idaho Geological Survey for collecting information on all nonfuel minerals.

Idaho ranked 30th among the 50 States in total nonfuel mineral production value[1] in 1997, according to the U.S. Geological Survey (USGS). The State was 27th in 1996. The estimated value for 1997 was $477 million, a 3% decrease from that of 1996. This followed a 3.7% decrease from 1995 to 1996 (based on final 1996 data). In 1997, the State accounted for more than 1% of the U.S. total nonfuel mineral production value.

Phosphate rock followed by gold, construction sand and gravel, and molybdenum were, by value, Idaho's leading nonfuel minerals in 1997. They accounted for about 72% of the State's total value. In 1997, most of the drop in value resulted from the drop in gold *(table 1)* plus lesser decreases in silver and industrial garnet. All other mineral commodities increased in value except for copper, lead, pumice and pumicite, and vanadium slag, all of which had small decreases. In 1996, most of Idaho's decrease in value was due to low molybdenum prices as compared to the substantially higher market prices for the metal during the first half of 1995 and a small decrease in the metal's production during 1996. Lime also showed a moderate decrease in value. Whereas phosphate rock and gold values significantly increased in 1996, the drop in molybdenum was 30% greater, resulting in a net decrease for the year.

Idaho remained the only State to produce antimony ore and vanadium slag, first of three industrial garnet-producing States, second in phosphate rock, third in lead, fourth in molybdenum, and sixth in feldspar. Idaho also continued as 6th of 13 gold-producing States, was 2d in silver, 5th in perlite, and dropped from 2d to 4th in pumice and pumicite. Additionally, the State was a significant producer of construction and industrial sand and gravel.

The following narrative information was provided by the Idaho Geological Survey[2] (IGS). Production data in the following text are those reported by the IGS, based on its own surveys and estimates. They differ from some production figures reported to the USGS.

For the first time in several years, Idaho's silver mines enjoyed a better year than the State's gold properties. By the end of 1997, silver prices were on the way up, but gold and base metal prices were down significantly, with the resulting toll on Idaho properties. Gold production in Idaho during 1997 totaled 10,300 kilograms, a drop from the 1996 record of 10,800 kilograms.

Continuing the trend from last year, Meridian Gold Inc.'s Beartrack Mine was the top gold producer in 1997, with 3,337 kilograms poured. Other major producers were Pegasus Gold Corp.'s Black Pine Mine, which extracted 1,371 kilograms before its scheduled shutdown in December, Kinross Gold Corp.'s DeLamar and Stone Cabin Mines (1,421 kilograms), and Dakota Mining Co.'s Stibnite Mine (472 kilograms). Ore reserves were exhausted at Black Pine, which opened in 1991. Reclamation efforts were underway at yearend. Hecla Mining Co.'s Grouse Creek operation in Custer County shut down in April.

Thompson Creek Mining Co. continued full operations at its Thompson Creek molybdenum mine in Custer County. In an innovative partnership, the company, along with local, State, and Federal agencies and fisheries groups, broke ground on a steelhead-rearing pond on Squaw Creek below the mine. The mine had a record year of production for the property, turning out about 9,100 metric tons of molybdenum concentrate and winning an "Excellence in Annual Operations" award from the Idaho Land Board.

Overall, exploration efforts in the State were down a bit, due largely to the softening metal prices. Industrial minerals and phosphate markets and operations were stable.

Mines in the Coeur d'Alene District of north Idaho have produced over 31,000 tons of silver since 1884. Investments in new technology, cost-cutting procedures, and new geologic work over the past few years have resulted in new ore body discoveries and increased production at a time when silver prices are looking quite favorable. Four deep, underground mines (Sunshine Mining and Refining Co.'s Sunshine Mine, Hecla's Lucky Friday Mine, and Silver Valley Resources Corp.'s Coeur and Galena Mines) extracted some 300 tons of silver in 1997, a 56% increase from the previous year. As a result, employment in Shoshone County has increased.

Production from the West Chance vein system in the Sunshine Mine boosted silver production to 132 tons in 1997, the highest since 1990. Exploration of the new galena-rich West Chance vein is delineating a resource of 1,900 tons of silver for Sunshine Mining and Refining Co. Hecla Mining Co. approved spending $16 million to develop the Gold Hunter ore body, which is about 1 mile north of the 1,495-meter level of the Lucky Friday Mine in Mullan. A development drift on the 1,556-meter level was completed early in the year. Over 59 tons of silver were produced

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[2]Virginia Gillerman, Research Economic Geologist, authored the text of the Idaho mineral industry information submitted by the Idaho Geological Survey.

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from Lucky Friday in 1997, and that may triple when Gold Hunter comes on line. The Lucky Friday mill is being expanded to handle the extra production, which should start in mid-1998.

Silver Valley Resources Corp., a joint venture of ASARCO Incorporated and Coeur d'Alene Mines Corp., operated both the Coeur and Galena Mines, which were restarted in 1996 after an extended closure. In May, the Galena Mine reached full production of 540 tons of ore per day. Production from the two mines totaled 107 tons of silver. A computer model was used to compile vast amounts of historical mine data at the Galena Mine. New vein discoveries include the 123 vein and 258 vein. Silver Valley also obtained leases on several claim blocks near the Galena and Caladay properties.

Cyprus Amax Minerals Co. put a major effort into exploration of the Petsite Project at Orogrande near Elk City in Idaho County. Petsite is a joint venture project between Cyprus Amax and Idaho Consolidated Metals Corp. (ICMC). Cyprus Amax drilled 90 reverse circulation and 11 core holes on the property, which is 1 of 3 ICMC projects along the gold-bearing Orogrande shear zone. Cyprus also drilled 14 reverse circulation holes at the Deadwood property along the Orogrande shear zone closer to Elk City.

ICMC retained 100% control of the Buffalo Gulch properties, located northwest of Elk City. Idaho Gold Corp., a subsidiary of Bema Gold, delineated and permitted a heap leachable deposit at Buffalo Gulch several years ago. In 1997, ICMC geologists completed a stream sediment, rock chip, and deep soil geochemical survey, as well as 24 line-miles of IP-Resistivity, looking for extensions of the Orogrande shear zone in the heavily forested terrain.

Bear Creek Mining, a small holding company based in Washington State, acquired and trenched the Mary Kay (Black Pine) workings just south of Elk City. They applied for permits to reopen the portal of the underground gold mine.

Meridian Gold Co. had an active year at its Beartrack Mine in Lemhi County near the historic site of Leesburg. The company expanded the leach pad significantly to accommodate the 3,370 kilograms extracted from some 4.1 million tons of ore. The mine was recognized as one of the six safest mines in the Nation by the Mine Safety and Health Administration. The company had an expanded exploration program, which included approximately 40 drill holes in the mine area.

Meridian spent $1 million to purchase the Arnett Creek property a few miles southwest of Beartrack and the Ditch Creek property, near North Fork, from Ghana-based Ashanti Goldfields, Inc. Meridian drilled 11 core holes on the Haidee claims at Arnett Creek. Meridian also purchased the Musgrove property from Atlas Mining Corp. for $200,000. In 1997, the Beartrack crew drilled 13 reverse circulation step out holes at Musgrove, which is 17 miles southwest of the mine.

Formation Capital Corp. continued its major effort on the Sunshine project near the Blackbird Mine in the Idaho Cobalt Belt of Lemhi County. Drilling focused on evaluation of the Ram zone discovered last year by soil geochemistry and mapping. The copper-cobalt-gold mineralization continues for over 427 meters along strike and 183 meters down dip, with the zone open in both directions. Work in 1997 completed 190 meters of trenching and 20 diamond drill holes totaling 3,674 meters. Drill intercepts reveal multiple ore horizons. Evaluation of the results and a new reserve calculation for this project are underway.

United States Antimony Corp. went underground at the Yellowjacket Mine, reducing gold production as the company focused on development work in the sulfide ore. Elsewhere in the region, Phelps Dodge Corp. mapped and drilled six reverse circulation holes, totaling 975 meters, on a copper target at Indian Creek. No additional work is planned.

Palouse Resources, a company based in Spokane, WA, staked claims and explored northeast of Ulysses Mountain near Sage Creek on a Proterozoic stratiform gold target. They did geologic mapping, geochemistry and ground magnetics surveys, and drilled two shallow Winkie core holes.

BHP Minerals Ltd. drilled four holes on the Blue Jay porphyry copper target in the Leadore District in southern Lemhi County.

Early in the year, Dakota Mining Corp. and USMX Inc. completed a merger, with Dakota taking over USMX's properties including the Dewey project in the Thunder Mountain Mining District, 32 kilometers east of Dakota's Stibnite Mine. Dakota completed mining of the Stibnite pit, and current reserves are depleted. Permitting work continued for the Thunder Mountain Mine, which is expected to be the focus of Dakota's future production in the area.

At Warren, CSC Mining Co. expanded the settling pond and reconstructed a road at the K Mine. Development work included 214 meters of new drift and 61 meters of raise on the high-grade gold vein.

Cambior Exploration Inc.'s Sultana copper-gold project near Mackay in Custer County was shut down in July after drilling eight additional core holes. During the 1995-97 program they drilled 7,350 meters in 47 core holes into the copper-gold skarn. The operator, Cambiex Exploration Inc., a subsidiary of Cambior Inc., announced an increase in the geologic resource estimate to 17 million tons at 0.49% copper, 0.19% zinc, 13.5 grams per ton Ag, and 0.48 grams per ton Au, with an additional 9 million tons of zinc-copper mineralization in the oxidized skarn. The company was evaluating its options at yearend.

Phelps Dodge Corp. drilled four holes in Copper Basin, southwest of Mackay, in Custer County. In February, Atlanta Gold Corp. and Voisey Bay Resources, Inc., agreed to form a new company, Twin Gold Corp., which would include Atlanta's property in Elmore County along the Middle Fork of the Boise River. Twin Gold signed an agreement with Quest International Resources Co. in July giving Quest a 20% interest in the Atlanta property for its $3.8 million investment in the mine area since 1993. Twin Gold is the project operator and is working on feasibility studies, permitting, and seeking financing for additional exploration.

International Freegold Minerals Development Inc. completed a feasibility study in July for the Idaho-Almaden project east of Weiser in Washington County. Freegold acquired an interest in the property in May 1996, when it reached an agreement with owners Ican Minerals Ltd., Ican Minerals Inc., and Canu Resources Inc. Idaho's largest mercury producer hosts 39 million tons of low-grade gold mineralization formed in a Tertiary hot springs system.

The Kilgore precious metal project of Echo Bay Mines, Ltd. was

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also inactive in 1997. Echo Bay did a major amount of work in 1995 and 1996, delineating a significant resource. The company is said to be interested in selling its interest.

Phosphate continued to be Idaho's largest mineral industry with over $600 million in processed mineral value in 1997. Idaho's four mines, FMC's Dry Valley Mine, J. R. Simplot Co.'s Smoky Canyon Mine, Rhone-Poulenc Basic Chemical Co.'s Rasmussen Ridge Mine, and Solutia Inc.'s Enoch Valley Mine, extracted over 6.5 million tons of ore during the year. Markets and production were good, and there were several corporate changes. In midyear, Monsanto spun off its chemicals division, which includes the phosphate operations, and renamed it Solutia Inc. FMC and Solutia operate elemental phosphorus plants, the only such plants in the United States, at Pocatello and Soda Springs, respectively. FMC announced in October that it would invest $73 million in new pollution control equipment at the Pocatello plant. Boise-based J.R. Simplot Co. and Agrium Inc., a Canadian agribusiness, operate fertilizer plants at Pocatello and Conda, respectively. Simplot acquired the assets and phosphate reserves of Alumet. Agrium announced plans to purchase the Rasmussen Ridge operation from Rhone-Poûlenc at yearend. Rhone-Poûlenc's mine had been supplying ore feed to the Agrium phosphoric acid fertilizer plant, which enjoyed a record year.

Strong demand for construction sand and gravel continued, fueled by Idaho's rapid population growth and development, particularly in the urban areas. Idaho's most unique aggregate operation is G & B Redi-Mix Co.'s pit near Star. Adjacent to the Boise River, the pit is actually a pond and gravel is extracted using a floating dredge. The dredging operation is more environmentally sound than a conventional pit.

Elsewhere, Ash Grove Cement Co. had an excellent year, increasing production 10%. The quarry and plant is at Inkom. Near Oakley, the Rodriguez Oakley Stone quarry reopened. Golconda Resources, Ltd. ended its diamond exploration project near McCall in Valley County. Bulk testing failed to find any diamonds, although indicator minerals were found.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN IDAHO 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995		1996		1997 p/	
		Quantity	Value	Quantity	Value	Quantity	Value
Antimony	metric tons	262	W	242	W	W	W
Clays, common		1	10	--	--	--	--
Gemstones		NA	346	NA	347	NA	352
Gold 3/	kilograms	8,850	110,000	10,800 r/	135,000 r/	10,300	111,000
Pumice and pumicite	metric tons	W	W	159,000	1,340	W	W
Sand and gravel:							
Construction		13,200	43,500	14,700	46,100	16,400	52,800
Industrial		501	8,720	646	8,510	663	8,540
Silver 3/	metric tons	182	30,200	229	38,300	W	W
Stone, crushed 4/		3,210	14,000	3,960	20,200	4,500	23,600
Combined value of cement, copper, feldspar, garnet (industrial), lead, lime, molybdenum, perlite [crude (1997)], phosphate rock, stone [crushed miscellaneous, dimension quartzite (1995), dimension quartzite and miscellaneous (1996-97)], vanadium, zinc, and values indicated by symbol W		XX	303,000	XX	242,000	XX	280,000
Total		XX	510,000	XX	492,000 r/	XX	477,000

p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data.
XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Recoverable content of ores, etc.
4/ Excludes certain stones; value included with "Combined value" data.

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TABLE 2
IDAHO: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 2/ Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	1996 2/ Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	7 r/	869 r/	$3,370 r/	$3.87	7	1,370	$7,920	$5.80
Granite	8	611	3,370	5.52	7	549	3,060	5.57
Traprock	31 r/	1,400 r/	5,720 r/	4.10	27	1,680	6,150	3.66
Shell	1	8	42	5.25	--	--	--	--
Quartzite	7	328	1,500	4.58	10	371	3,110	8.40
Total	XX	3,210	14,000	4.36	XX	3,960	20,200	5.11

r/ Revised. XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excludes miscellaneous stone from State total to avoid disclosing company proprietary data.

TABLE 3
IDAHO: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Filter stone	6	$30	$5.00
Other coarse aggregate 3/	241	745	3.09
Coarse aggregate, graded:			
Concrete aggregate, coarse	W	W	2.15
Bituminous aggregate, coarse	189	670	3.54
Bituminous surface-treatment aggregate	W	W	2.46
Railroad ballast	W	W	9.00
Fine aggregate (-3/8 inch):			
Stone sand, concrete	39	152	3.90
Stone sand, bituminous mix or seal	136	537	3.95
Coarse and fine aggregates:			
Graded road base or subbase	202	537	2.66
Unpaved road surfacing	815	3,350	4.11
Crusher run or fill or waste	32	121	3.78
Other coarse and fine aggregates	110	423	3.85
Other construction materials	256	606	2.37
Agricultural:			
Agricultural limestone	(4/)	(4/)	2.87
Poultry grit and mineral food	6	21	3.50
Other agricultural uses	18	61	3.39
Chemical and metallurgical:			
Cement manufacture	(4/)	(4/)	2.76
Lime manufacture	(4/)	(4/)	12.13
Flux stone	(4/)	(4/)	11.04
Sulfur oxide removal	(5/)	2	3.31
Special:			
Mine dusting or acid water treatment	(5/)	(5/)	4.07
Other fillers or extenders	18	254	14.11
Unspecified: 6/			
Actual	267	2,310	8.65
Estimated	70	206	2.94
Total	3,960	20,200	5.11

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Includes granite, limestone, quartzite, shell, and traprock; excludes miscellaneous stone from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits, except for unit value; may not add to totals shown.
3/ Includes riprap and jetty stone.
4/ Withheld to avoid disclosing company proprietary data; included in "Total."
5/ Less than 1/2 unit.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
IDAHO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	2,310	$9,950	$4.32
Plaster and gunite sands	23	56	2.43
Concrete products (blocks, bricks, pipe, decorative, etc.)	55	189	3.44
Asphaltic concrete aggregates and other bituminous mixtures	1,020	3,390	3.34
Road base and coverings	5,180	16,100	3.10
Fill	610	1,470	2.40
Snow and ice control	73	497	6.81
Other miscellaneous uses 2/	135	524	3.88
Unspecified: 3/			
Actual	1,190	3,580	3.02
Estimated	4,100	10,300	2.52
Total or average	14,700	46,100	3.14

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filtration and railroad ballast.
3/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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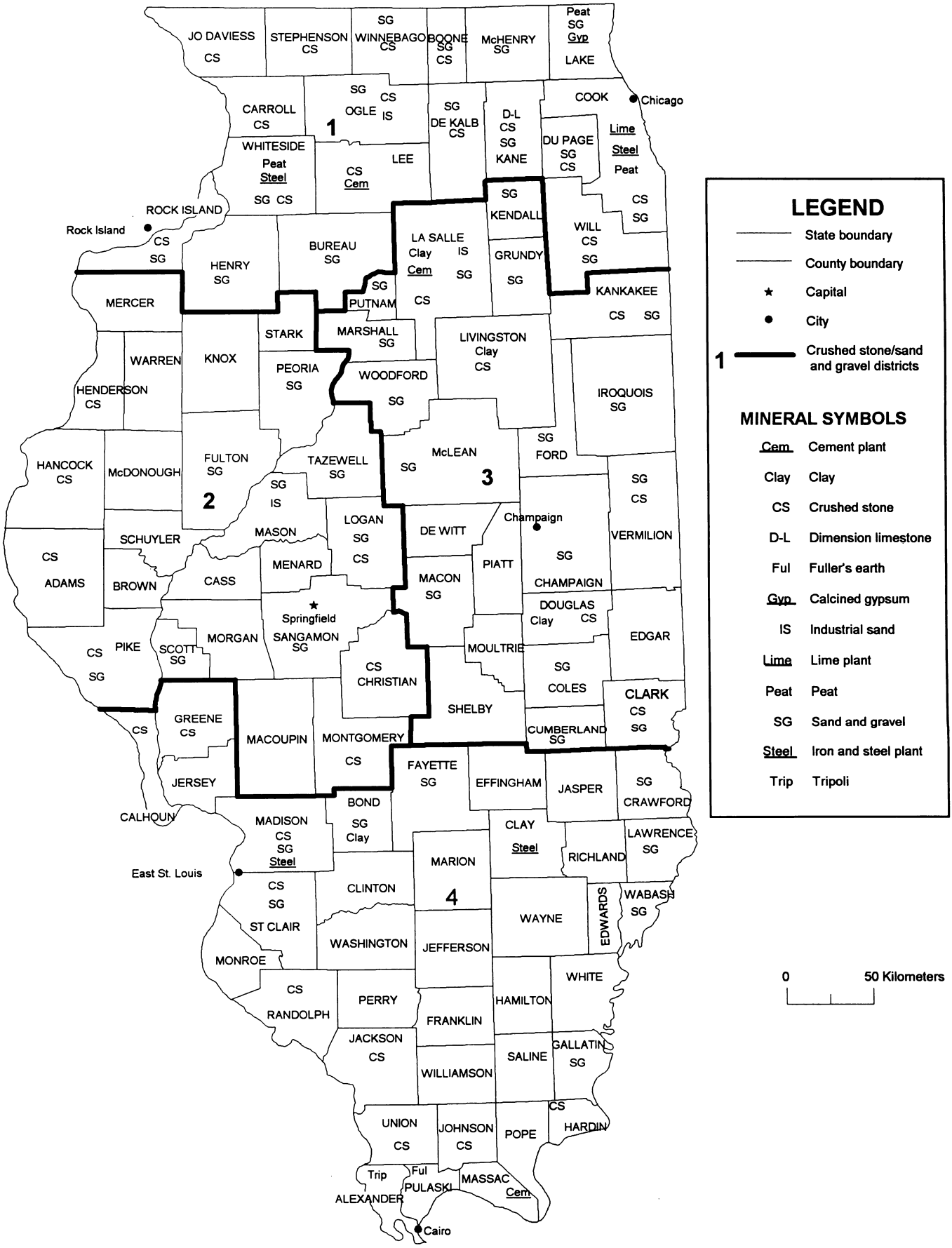

Source: Illinois State Geological Survey/U.S. Geolgical Survey

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THE MINERAL INDUSTRY OF ILLINOIS

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Illinois State Geological Survey for collecting information on all nonfuel minerals.

In 1997, Illinois ranked 17th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The State had ranked 16th for the previous 7 years. The estimated value for 1997 was $880 million, a 4% increase from the $846 million achieved in 1996. This followed a 2.2% increase from 1995 to 1996 (based on final 1996 data). The State accounted for more than 2% of the U.S. total nonfuel mineral production value.

Illinois' total nonfuel mineral production value in 1997 resulted from the production of industrial minerals. In terms of nonfuel mineral value, crushed stone was the State's leading commodity, accounting for 44% of the total, followed by portland cement with 21%, and construction sand and gravel with 18%. A 7%, or $25 million, increase in the estimated value of crushed stone, and an 11%, or $16 million, increase in construction sand and gravel led the State's increase in total nonfuel mineral production value (*table 1*). There were no significant drops in the values of any of the State's nonfuel mineral values. In 1996, less than $10 million decreases in each of fluorspar, lime, and zinc were more than compensated for by the combined increases of crushed stone, portland cement, and tripoli, resulting in the year's overall increase *(table 1)*.

Compared with USGS estimates of the quantities of minerals produced in the other 49 States, Illinois remained first in industrial sand and gravel and tripoli in 1997, third in peat, fourth in fuller's earth, fifth in crushed stone, seventh in lime, and eighth in portland cement. The State rose from ninth to eighth in gemstones (by value) and dropped from seventh to eighth in the production of construction sand and gravel. Raw steel was produced in Illinois, but it was processed from materials obtained from other domestic and foreign sources. Illinois remained fourth in the Nation in the manufacture of raw steel with an estimated output of 7.4 million metric tons (8.2 million short tons), according to the American Iron and Steel Institute.

The following narrative information was provided by the Illinois State Geological Survey[2] (ISGS). On November 14, 1997, an exemption from Illinois Sales and Use Taxes (P.A. 90-529) became effective for all machinery and equipment required to produce noncoal minerals. The tax exemption includes the purchase of all machinery and equipment used for mineral exploration, mining, off-highway hauling, mineral processing, maintenance, and reclamation. It also provides that "equipment purchased for lease" is tax exempt. Probably the most significant provision is that the exemption extends to replacement parts and equipment. This tax exemption will help support the vitality and growth of construction aggregate and other mineral producing industries in Illinois. It gives them the same tax benefits enjoyed by coal and oil producers, farmers, graphic arts companies, and other key parts of the State's economy. It also gives them tax breaks similar to ones enjoyed by competing producers in adjacent States, such as Indiana, where a broader tax break is given for aggregate and other mineral production machinery and equipment.

The construction aggregate industry had a productive year in 1997 and maintained a strong base for future productivity. In the Chicago metropolitan area (northeastern Illinois), Vulcan Materials Co. successfully replaced production from its old Joliet Quarry with that of the new Laraway Quarry, a few miles farther south of Joliet. An early emphasis on good community relations greatly assisted this accomplishment. In order to supply the booming construction market in Lake County, Vulcan constructed rail yards in the county and is now shipping crushed stone in from Wisconsin on unit trains. In Kankakee County, the company completed construction of its Manteno lime plant and idled its Momence Quarry. Also in Kankakee County, a closed operation, the Niner Quarry, was reopened in 1997 by a new company, the Bedrock Stone Co.

McHenry Co., located on the northeastern corner of the metropolitan Chicago area, contains some of the largest and highest quality gravel deposits in the State. Gravel mining was well established early this century when the railroad was the only way to get material to market. In recent years, the county has been experiencing unprecedented real estate development, which is in part responsible for the strong negative attitude that exists today against the mining industry. It is very difficult to open new operations in such an environment. Over the last couple of years, Meyer Material Co. managed to increase its production by acquiring three existing operations; Griebel Sand and Gravel, Harvard Ready Mix, and Powell Sand and Gravel. At the same time, they improved their reserve position by purchasing or leasing properties adjacent to the new acquisitions. The company has also

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]John H. Masters, Senior Staff Geologist with the Illinois State Geological Survey authored the text of information submitted by that agency.

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been working on its public image by explaining its plans to its neighbors in advance of any new activity.

A northern Illinois company that experienced significant growth in 1997, often by purchasing smaller operations, is the Prairie Group. The Prairie Group purchased four sand and gravel plants in northeastern Illinois from Road Materials Corp., including one plant on the south side of Elgin. In cooperation with the city, a quarry has been developed by the Prairie Group in the stone that was found below their sand and gravel operation. As mining continues, the 19-hectare site is being progressively reclaimed into a public recreation center with many ball fields and a large lake. Prairie has purchased three quarries from Markgraf Materials: two in Livingston County and one in Iroquois County. They purchased the North-Central Materials quarry in Kankakee County and have acquired adjacent property. At their Dixon-Marquette Cement operation in Lee County, they have built a modern processing plant on the floor of their old cement-rock quarry that is capable of either supplying limestone to the cement manufacturing plant or producing portland cement-grade aggregate from their dolomite reserves. They have also acquired a sand and gravel operation and ready-mix plants in central Illinois.

In northwestern Illinois, crushed stone and sand and gravel producers are in the process of closing their smaller and more isolated operations and increasing production at their more economic sites. Also, a few smaller companies have been bought by bigger ones that are better equipped to cope with economic and environmental problems. These trends are accompanied by the State-wide trend over the last few years of less State and local money being available for road, bridge, and other types of infrastructure construction and maintenance projects. One of the larger companies in the region, Moline Consumers Co., has initiated a long term program of successively replacing aggregate production plants built in the late 1950's with more efficient, fully automated plants at its Allied, Cleveland, and Midway quarries. By purchasing surrounding properties over the years, these sites have large reserves that, like the new plants, will be developed using the latest environmental and technological methods. Because the company expects production from these three quarries to increase significantly, it is concerned about increasing costs and environmental and safety factors related to increasing truck traffic. Therefore the company is taking a new look at rail and barge transportation of aggregates, especially to more distant markets. This trend toward fewer, but bigger operations tends to favor the development of rock quarries over sand and gravel pits in northwestern Illinois. In this area, relatively thick limestone and dolomite rock units are present near the surface. These rock units can be quarried at favorable sites for many more years, with fewer product quality and environmental problems than are encountered at most sand and gravel sites in this area.

Martin Marietta Aggregates is continuing to move back into the Illinois construction aggregates industry. Its River Central District has opened a new office in Paducah, KY. It will manage the three quarries the company acquired in 1997 with the purchase of Hardin County Materials in the southeastern-most part of Illinois in Hardin County. Included in the purchase was Rock Dust Products, a company that grinds locally mined limestone to a powder. This "dust" is commonly used as a safety precaution by spraying it on the interior surfaces of underground coal mines in order to suppress potentially explosive coal dust. The River Central District will also manage the newly purchased Kaskaskia Stone Co. (Stotz Mine), acquired from Perry County Stone Co. of Missouri. It is a horizontal adit mine in the east bluff of the Mississippi River valley, located in Randolph County about 129 kilometers south of East St. Louis. Other adit-type limestone mines in the bluffs of the same region have been idled or closed in recent years due to market and transportation problems. Mines affected include: the Valmeyer Mine of the Columbia Quarry Co., the Solvay Mine of Bluff City Materials, Inc., and in 1997, the Chester Mine of Midland Terminal Co.

Illinois once again led the nation in 1997 in the production of silica sand, mainly due to the productivity of Unimin Corp., U.S. Silica Co., and Wedron Silica Co. These companies in northern Illinois (La Salle and Ogle Counties) mine a high-purity quartz sandstone. More silica sand is consumed by the glass manufacturing industry than any other industry. Several years ago, Manito Investment Co. added a quartz-feldspar glass sand to its line of foundry sand products. The company mines surficial sand dune deposits in central Illinois (Mason County). The quartz-feldspar product was sold to Hillsboro Glass Co. (Montgomery County) for the manufacture of amber glass bottles, however Manito lost that market when Hillsboro closed its glass plant in 1997.

Although fluorspar is no longer mined commercially in southeastern Illinois, Hastie Mining and Trucking Co., a quarry company in Hardin County, continues to lease Ozark-Mahoning Co.'s mineral drying and bagging facilities in Rosiclare. Hastie processes fluorspar purchased from the National Defense Stockpile.

The new American Fluorite Museum in Rosiclare, about 2 kilometers north of the Ohio River in Hardin Co., is now open on a limited time basis. Tours of the facilities are being given. The museum is on the grounds of the former Rosiclare Lead and Fluorspar Mining Co. The office building has been restored, with a gift shop and displays inside. The smoke stack, processing plant, and flotation mill no longer exist. The hoist house and other buildings are being restored. Future plans include the possibility of exposing a portion of the vein at the surface, providing visitors an opportunity to see a part of one of the largest fissure-vein fluorspar deposits in the United States.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN ILLINOIS 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Cement, portland		2,560	169,000	2,620	181,000 e/	2,670	189,000 e/
Clays:							
Common		503	1,220	115	736	128	642
Fuller's earth		332	W	330	W	330	W
Fluorspar	metric tons	51,400	W	8,180	W	NA	W
Gemstones		NA	269	NA	890	NA	1,200
Sand and gravel:							
Construction		36,100	147,000	34,600	144,000	37,500	160,000
Industrial		4,410	67,500	4,460	66,400	4,490	65,900
Stone, crushed		61,400	335,000	66,500	364,000	70,000	389,000
Combined value of barite (1995), copper (1995-96), lead (1995-96), lime, peat, silver (1995-96), tripoli (1995-96), zinc, (1995-96) and values indicated by symbol W		XX	107,000	XX	89,100	XX	74,500
Total		XX	828,000	XX	846,000	XX	880,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
ILLINOIS: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone 2/	134 r/	53,700 r/	$296,000 r/	$5.50 r/	127	57,700	$319,000	$5.52
Dolomite	21 r/	7,690 r/	39,700 r/	5.17 r/	19	8,800	45,000	5.11
Total	XX	61,400	335,000	5.46	XX	66,500	364,000	5.47

r/ Revised. XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes limestone-dolomite reported with no distinction between the two.

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TABLE 3
ILLINOIS: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	783	$3,910	$5.00
Riprap and jetty stone	566	4,270	7.54
Filter stone	146	864	5.92
Other coarse aggregate	270	1,600	5.93
Coarse aggregate, graded:			
Concrete aggregate, coarse	6,830	37,600	5.50
Bituminous aggregate, coarse	4,830	29,600	6.12
Bituminous surface-treatment aggregate	1,640	10,200	6.21
Railroad ballast	557	2,930	5.26
Other graded coarse aggregate	289	1,550	5.36
Fine aggregate (-3/8 inch):			
Stone sand, concrete	507	2,160	4.27
Stone sand, bituminous mix or seal	306	1,300	4.25
Screening, undesignated	1,040	4,290	4.13
Other fine aggregate	11	72	6.55
Coarse and fine aggregates:			
Graded road base or subbase	9,630	42,900	4.46
Unpaved road surfacing	3,120	14,600	4.67
Crusher run or fill or waste	380	1,660	4.36
Other construction materials 3/	1,330	7,240	5.44
Agricultural:			
Agricultural limestone	2,500	11,100	4.45
Poultry grit and mineral food	78	1,470	18.87
Other agricultural uses	W	W	2.80
Chemical and metallurgical:			
Cement manufacture	2,360	9,080	3.84
Flux stone	W	W	5.52
Chemical stone	527	2,610	4.96
Sulfur oxide removal	W	W	3.55
Special:			
Mine dusting or acid water treatment	W	W	11.25
Asphalt fillers or extenders	W	W	5.17
Other fillers or extenders	W	W	53.91
Unspecified: 4/			
Actual	18,000	97,300	5.39
Estimated	9,950	50,000	5.03
Total	66,500	364,000	5.47

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, limestone, and limestone-dolomite.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes other coarse and fine aggregates.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
ILLINOIS: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 2/	891	4,770	229	1,660	282	2,270	364	1,950
Coarse aggregate, graded 3/	W	W	W	W	W	W	2,870	14,600
Fine aggregate (-3/8 inch) 4/	W	W	W	W	W	W	158	671
Coarse and fine aggregate 5/	6,980	30,500	725	3,350	3,500	17,400	3,090	14,100
Other construction materials	8,570	48,500	271	1,840	4,310	25,000	–	--
Agricultural 6/	(7/)	(7/)	(7/)	(7/)	932	4,930	819	3,660
Chemical and metallurgical 8/	(7/)	(7/)	–	–	(7/)	(7/)	(7/)	(7/)
Special 9/	–	--	(7/)	(7/)	(7/)	(7/)	(7/)	(7/)
Unspecified: 10/								
Actual	11,400	59,400	3,230	20,800	1,010	6,390	2,440	10,700
Estimated	3,480	17,500	1,320	6,470	1,520	7,600	3,620	18,400
Total	32,700	166,000	6,640	60,000	13,200	70,900	14,000	67,000

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other coarse aggregate
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
6/ Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.
7/ Withheld to avoid disclosing company proprietary data; included in "Total."
8/ Includes cement manufacture, chemical stone for alkali works, flux stone, and sulfur oxide removal.
9/ Includes asphalt fillers or extenders, mine dusting or acid water treatment, and other fillers or extenders.
10/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
ILLINOIS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	7,390	$28,100	$3.80
Plaster and gunite sands	303	1,120	3.70
Concrete products (blocks, bricks, pipe, decorative, etc.)	855	3,760	4.39
Asphaltic concrete aggregates and other bituminous mixtures	1,560	6,150	3.93
Road base and coverings 2/	5,520	30,300	5.49
Fill	3,260	11,200	3.45
Snow and ice control	34	169	4.97
Other miscellaneous uses 3/	246	1,420	5.76
Unspecified: 4/			
Actual	10,800	44,400	4.10
Estimated	4,560	17,500	3.84
Total or average	34,600	144,000	4.17

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes filtration and roofing granules.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6

ILLINOIS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	4,650	18,800	921	2,920	1,770	7,110	1,210	4,140
Asphaltic concrete aggregates and road base materials 3/	4,730	26,000	533	2,140	1,240	6,080	567	2,200
Fill	1,820	6,230	312	915	926	3,540	207	558
Snow and ice control	16	78	--	--	18	90	(4/)	(4/)
Other miscellaneous uses 5/	121	702	44	345	80	371	--	--
Unspecified: 6/								
Actual	8,860	38,400	653	3,030	982	2,100	347	877
Estimated	2,390	10,600	687	2,230	836	2,180	645	2,490
Total	22,600	101,000	3,150	11,600	5,860	21,500	2,980	10,300

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement).
4/ Less than 1/2 unit.
5/ Includes filtration and roofing granules.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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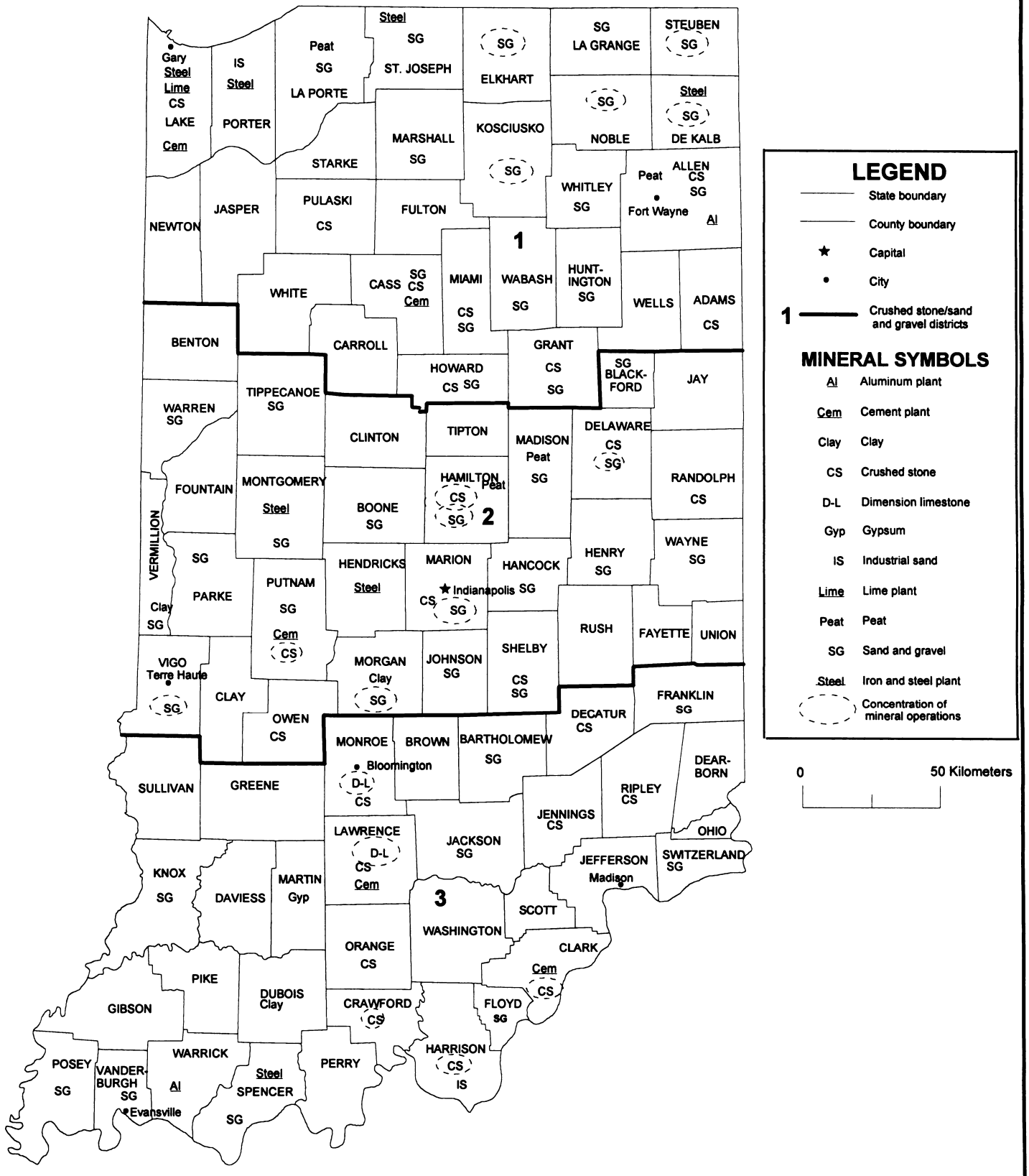
INDIANA



LEGEND

- State boundary
- County boundary
- ★ Capital
- • City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Al	Aluminum plant
Cem	Cement plant
Clay	Clay
CS	Crushed stone
D-L	Dimension limestone
Gyp	Gypsum
IS	Industrial sand
Lime	Lime plant
Peat	Peat
SG	Sand and gravel
Steel	Iron and steel plant
(oval)	Concentration of mineral operations

0 — 50 Kilometers

Source: Indiana Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF INDIANA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Indiana Geological Survey for collecting information on all nonfuel minerals.

Indiana ranked 21st among the 50 States in total nonfuel mineral production value[1] in 1997, according to the U.S. Geological Survey (USGS). Although dropping from a ranking of 20th in 1996, Indiana's 1997 estimated value of $639 million was up about 2% compared with that of 1996. This followed a 6.6% increase from 1995 to 1996 (based on final 1996 data). The State accounted for more than 1.5% of the U.S. total nonfuel mineral production value.

Indiana's increase in value in 1997 mostly resulted from an $18 million, or 7%, increase in the value of crushed stone and a $6 million, or 4%, increase in portland cement. These increases more than compensated for a 14% decrease in construction sand and gravel value *(table 1)*. Compared with 1996, all other nonfuel mineral values increased except for those of common clays and peat, which decreased slightly.

Compared with USGS estimates of the quantities of minerals produced in the other 49 States during 1997, Indiana remained first in dimension stone, second in masonry cement, seventh in gypsum, and eighth in lime. Indiana ranked 7th in ball clay production, dropped from 4th, to 6th, in peat and from 6th, to 10th in common clays. Additionally, the State was a significant producer of crushed stone, portland cement, and construction sand and gravel, ranking 12th, 12th, and 14th, respectively. The State's mines exclusively produce industrial minerals and coal; all raw steel and primary aluminum produced in the State are processed from materials received from other domestic and foreign sources. Based on USGS estimates, the State remained third in the production of primary aluminum. Indiana continued to lead the Nation in the production of raw steel with an estimated output of about 23 million metric tons (25 million short tons), according to the American Iron and Steel Institute preliminary estimates.

The following narrative information was provided by the Indiana Geological Survey[2] (IGS). In 1997, new sand and gravel pits were opened by Niblock Excavating, Inc. in Elkhart County; Rieth-Rielly Construction Co., Inc. in St. Joseph County; Esters', Inc. in Shelby County; and Evansville Materials, Inc. in Vanderburgh County. In addition, Kokomo Gravel, Inc., operated next to the abandoned Martin Marietta Aggregates gravel plant near Kokomo, Howard County. Martin Marietta Aggregates will be opening a new sand plant in Howard County. S&G Excavating Co., Inc. opened a new crushed stone quarry in Putnam County called Lincoln Park Stone and a new sand and gravel plant at Montezuma in Parke County. A new dimension limestone quarry, called Walton Quarries, Inc., opened in Lawrence County.

Among major closings, Martin Marietta Aggregates closed its Utica Sand and Gravel plant in Clark County and stopped producing sand at its 96th Street plant, Hamilton County. Leary's Gravel Co., Inc., closed its sand and gravel operation in Hancock County and Old Prairie Products, Inc., closed its gravel plant at Liberty Center, Wells County. Cowles Sand and Gravel, Inc., Fulton County, closed its Collins pit, moved across the road and opened the McKinney farm pit. CBB, Inc., closed its aggregate pit in Lake County, but continues to haul for other companies. Shelby Gravel, Inc., closed two sand and gravel operations in Shelby County and opened another in the same county. Also, Fisher's Asphalt Sand and Gravel, Starke County, was sold and closed.

Several acquisitions occurred in the aggregates industry. Martin Marietta Aggregates acquired the Indiana holdings of American Aggregates, with the exception of the Richmond plant in Wayne County, but sold the Harding Street crushed stone quarry in Marion County to Cornerstone/Benchmark Materials Midwest (the Kentucky Stone Co.) because of antitrust laws. American Aggregates sold the Richmond plant to U.S. Aggregates. Martin Marietta Aggregates also acquired the O.K. Sand and Gravel Co., Inc., in Marion County. Richard Klink Sand & Gravel, Steuben County, was acquired by S.E. Johnson Companies, and is now called London Aggregates. West Terre Haute Sand and Gravel, Vigo County, was acquired by JAB Aggregates and Trucking. Elkhart County Gravel Corp. acquired the Vulcan Materials Co.'s Middlebury pit and now has two pits in the Middlebury, Elkhart County, area. Stockberger Group acquired H & K Farms Aggregate Div., Marshall County, which is very near its current operation, but is not currently mining there. The Edward C. Levy Co., Inc., acquired the Vulcan Materials Co. South Bend, St. Joseph County, sand and gravel plant and renamed it Levy Indiana Slag, although no slag is sold at that location. In addition to aggregates, an acquisition occurred in the cement industry when Italy's Italcementi Group acquired ESSROC Materials, Inc., Cass and Clark Counties, and renamed the plants Essroc Cement Corp. In other company changes, Christner Gravel Co., Inc., Ellchart County, was renamed Christner-Schrock Aggregate Co. Morocco Sand and Gravel Co., Jasper County, was purchased by one of its

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Ms Kathryn Shaffer authored the text of State minerals information submitted by the Indiana Geological Survey.

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partners who changed the name to Northwest Indiana Aggregates. Big Lake Stone and Sand, Noble County, changed its name to Tri-County Gravel, Inc.

State legislators passed a new budget in May that provides approximately $687 million over 4 years for highway construction. The State's general assembly set aside an additional $100 million from the State's $1.6 billion surplus over the next 2 years for State road repairs, with money apportioned to all towns and cities on the basis of size and population. Legislators continued with efforts to obtain more Federal funds to support an extension of I-69 between Bloomington and Evansville, and other road construction projects.

The introduced State bills which became law were as follows: HB 1541 redefines the term "special waste" for certain environmental laws to exclude ceramic block materials, fire brick, fire clay, iron and steel slag, some refactory brick, and refractory earth, and makes unnecessary the acquisition of an environmental permit for certain uses of foundry sand; SB 169 allows the disposal of waste tires at mineral extraction sites if the disposer owns or leases the mineral site, if the waste tires were used on off-road construction or mining vehicles or other equipment, and if they are buried at least 25 feet underground; and HB 1992 deals with many environmental issues, and contains the provision that mineral owners or leaseholders will be notified of and allowed to respond to any water protection zones established around community water system wells.

The Indiana Department of Environmental Management will open a Southwest Regional Office in the Evansville area in late summer or early fall 1998. Monroe County passed a new zoning ordinance allowing crushing of minerals in mineral extraction zones but also placed several restrictions on such operations. Hoosier Calcium, which operates an underground limestone mine in Monroe County primarily for glass manufacture, will install equipment for dust control. Essroc Cement Corp. received permission from the State to burn tires for fuel at its Clark County operation but is still investigating the economics.

The Indiana Mineral Aggregates Association along with the Indiana Department of Transportation and the Federal Highway Administration conducted a $75,000 Superpave study testing a variety of fine aggregate mixtures using Indiana materials. More cooperative studies may be conducted in the future.

Indiana continued to produce more steel than any State in the nation and several developments occurred in the industry. Construction of the $1.1 billion AK Steel Corp. plant in Rockport, Spencer County, continued with completion scheduled for late 1998. The new Spencer County Port Authority plans to build a new port on the Ohio River at Rockport and to connect the Port to the AK Steel Corp. plant with a 11.3-kilometer railway extension. Bethlehem Steel Corp., Porter County, announced plans to purchase Lukens, Inc. As part of the deal, two plate steel mills in Burns Harbor will be consolidated, as well as four others outside Indiana. Construction has begun on the Qualitech Steel Corp. minimill near Pittsboro, Hendricks County. Ground was broken in April for Wayne Steel, Inc.'s, new $9 million steel plant in Clark Maritime Centre, Clark County. Paragon Steel and Feralloy North American Steel will build a $4 million plant in Butler, DeKalb County, next to the Steel Dynamics, Inc.'s minimill. USX-US Steel Group, Inc., Lake County, is modernizing its plate mill at a cost of $40 million to allow product improvement and the addition of other products. National Steel Corp., Porter County, sold a coke oven battery to a subsidiary of DTE Energy Co., but will continue to purchase coke from that company. Additionally, National Steel Corp. contracted to operate and maintain the coke battery for 12 years. A cogeneration electric powerplant will be built at Burns Harbor using waste heat from a new Inland Steel Industries, Inc., coke-producing facility. The plant will provide power for Inland Steel Industries, Inc., Lake County.

A new secondary aluminum smelter with a projected production capacity range of 5,400 to 6,800 tons per year is being built at New Haven, Allen County, by Superior Aluminum Alloys. The IMCO aluminum recycling plant in Bedford, Lawrence County, is expanding.

At the IGS, a new Directory of Industrial Minerals Producers in Indiana was completed as well as an update of Miscellaneous Map 41, Map of Indiana Showing Locations of Coal and Industrial Minerals Operations.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN INDIANA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement, portland	2,330	143,000	2,350	153,000 e/	2,390	160,000 e/
Clays:						
Ball	38	W	38	W	38	W
Common	877	3,350	1,510	3,500	915	2,780
Gemstones	NA	36	NA	3	NA	3
Peat	17	281	W	W	W	W
Sand and gravel, construction	24,900	93,900	24,800	100,000	20,800	85,900
Stone:						
Crushed	49,200	234,000 3/	53,700 3/	254,000 3/	55,600 3/	272,000 3/
Dimension metric tons	172,000	31,400	156,000 3/	24,500 3/	157,000 3/	24,600 3/
Combined value of cement (masonry), gypsum (crude), lime, sand and gravel (industrial), stone [crushed slate, dimension dolomite (1996-97)], and values indicated by symbol W	XX	82,700	XX	92,800	XX	94,700
Total	XX	589,000	XX	628,000	XX	640,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined value" data.

TABLE 2
INDIANA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone 2/	73	42,400	$201,000	$4.73 r/	75	46,500	$217,000	$4.66
Dolomite	14	6,760	33,500	4.96	14	7,170	37,400	5.22
Slate	1	74	(3/)	(3/)	(4/)	(4/)	(4/)	(4/)
Total	XX	49,200	234,000	4.76	XX	53,700	254,000	4.73

r/ Revised. XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes limestone-dolomite reported with no distinction between the two.
3/ Excludes slate value from State total to avoid disclosing company proprietary data.
4/ Excludes slate from State total to avoid disclosing company proprietary data.

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TABLE 3
INDIANA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	57	$181	$3.18
Riprap and jetty stone	1,180	5,440	4.61
Filter stone	408	2,090	5.11
Other coarse aggregate	277	1,570	5.68
Coarse aggregate, graded:			
Concrete aggregate, coarse	5,310	19,900	3.75
Bituminous aggregate, coarse	3,940	15,300	3.89
Bituminous surface-treatment aggregate	1,750	6,410	3.67
Railroad ballast	376	1,610	4.29
Other graded coarse aggregate	1,480	2,390	1.62
Fine aggregate (-3/8 inch):			
Stone sand, concrete	237	1,050	4.43
Stone sand, bituminous mix or seal	284	1,530	5.38
Screening, undesignated	215	745	3.47
Other fine aggregate	W	W	7.37
Coarse and fine aggregates:			
Graded road base or subbase	4,060	18,500	4.55
Unpaved road surfacing	3,900	19,300	4.94
Terrazzo and exposed aggregate	W	W	4.67
Crusher run or fill or waste	1,290	5,910	4.57
Other coarse and fine aggregates	287	1,360	4.73
Agricultural limestone 3/	1,510	7,840	5.20
Chemical and metallurgical:			
Cement manufacture	3,530	9,270	2.63
Dead-burned dolomite manufacture	(4/)	(4/)	4.64
Flux stone	(4/)	(4/)	2.53
Chemical stone	(4/)	(4/)	7.00
Sulfur oxide removal	859	3,190	3.71
Other specified uses not listed	(4)	(4)	6.59
Unspecified: 5/			
Actual	19,100	111,000	5.84
Estimated	3,550	19,000	5.34
Total	53,700	254,000	4.73

W Withheld to avoid disclosing company proprietary data; included with "Other coarse and fine aggregates."
1/ Includes dolomite, limestone, and limestone-dolomite; excludes slate from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes other agricultural uses.
4/ Withheld to avoid disclosing company proprietary data; included in "Total."
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
INDIANA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	W	W	W	W	1,020	$4,610
Coarse aggregate, graded 4/	W	W	W	W	W	W
Fine aggregate (-3/8 inch) 5/	W	W	W	W	W	W
Coarse and fine aggregate 6/	8,300	$38,000	3,260	$14,700	12,500	45,900
Agricultural 7/	(8/)	(8/)	(8/)	(8/)	(8/)	(8/)
Chemical and metallurgical 9/	(8/)	(8/)	(8/)	(8/)	(8/)	(8/)
Other miscellaneous use 10/	(8/)	(8/)	--	--	--	--
Unspecified: 11/						
Actual	4,480	26,500	11,500	69,500	3,090	15,300
Estimated	1,960	10,200	151	814	1,44	7,920
Total	16,100	79,600	15,700	86,400	22,000	88,300

W Withheld to avoid disclosing company proprietary data; included with "Coarse and fine aggregate."
1/ Excludes slate from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroadballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
7/ Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes cement manufacture, chemical stone for alkali works, dead-burned dolomite manufacture, flux stone, and sulfur oxide removal.
10/ Includes other specified uses not listed.
11/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
INDIANA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	8,350	$30,800	$3.69
Plaster and gunite sands	89	611	6.87
Concrete products (blocks, bricks, pipe, decorative, etc.)	187	1,140	6.12
Asphaltic concrete aggregates and other bituminous mixtures	1,370	6,000	4.39
Road base and coverings 2/	1,430	5,550	3.88
Fill	2,520	10,600	4.19
Snow and ice control	247	740	3.00
Other miscellaneous uses 3/	176	1,090	6.20
Unspecified: 4/			
Actual	7,770	33,900	4.37
Estimated	2,700	9,590	3.55
Total or average	24,900	100,000	4.03

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes filtration.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
INDIANA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	1,920	6,180	4,030	19,300	2,680	7,030
Asphaltic concrete aggregates and road base materials 3/	1,150	5,020	1,150	4,740	494	1,780
Fill	409	1,050	1,950	9,160	166	357
Snow and ice control	150	448	73	238	24	54
Other miscellaneous uses 4/	92	561	61	393	23	137
Unspecified: 5/						
Actual	902	4,250	4,870	19,500	2,000	10,200
Estimated	1,380	4,630	964	3,530	359	1,430
Total	6,000	22,100	13,100	56,900	5,740	21,000

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement and lime).
4/ Includes filtration.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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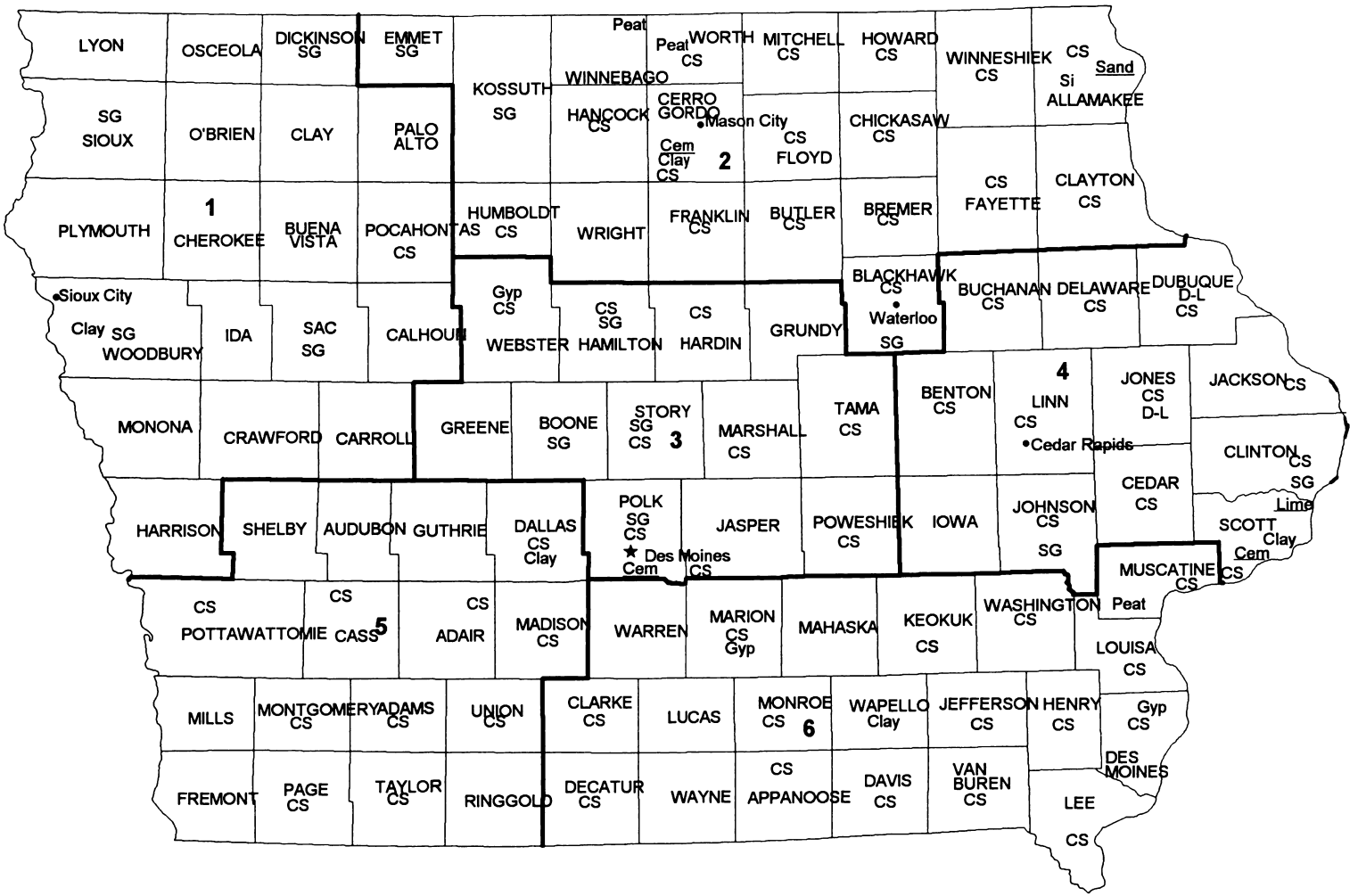
IOWA



LEGEND

- State boundary
- County boundary
- ★ Capital
- • City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Cem	Cement plant
Clay	Clay
CS	Crushed stone
DL	Dimension limestone
Gyp	Gypsum
Lime	Lime plant
Peat	Peat
Sand	Sand plant
SG	Sand and gravel
Si	Silica

0 50 Kilometers

Source: Iowa Geological Survey Bureau/U.S. Geological Survey

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THE MINERAL INDUSTRY OF IOWA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Iowa Geological Survey Bureau for collecting information on all nonfuel minerals.

In 1997, for the third consecutive year, Iowa was 29th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $493 million, about a 5% increase from that of 1996. This followed a 3.1% increase from 1995 to 1996 (based on final 1996 data). The State accounted for more than 1% of the U.S. total nonfuel mineral production value.

Crushed stone remained the leading commodity, accounting for more than 44% of the State's total nonfuel mineral value, followed by portland cement with nearly 40% and construction sand and gravel with almost 11%. Most of Iowa's increased nonfuel mineral production value in 1997 resulted from the increases in crushed stone and portland cement (*table 1*). Most of the State's other nonfuel minerals increased in value except construction sand and gravel and common clays, which showed small drops. Industrial sand and gravel remained the same. In 1996, the increased value of portland cement, mitigated by drops in crushed stone and construction sand and gravel, accounted for most of the State's $14 million increase.

Compared with USGS estimates of quantities produced in the other 49 States, Iowa remained 2d in crude gypsum and 10th in portland cement. Additionally, the State was a significant producer of crushed stone and construction sand and gravel. No metals were mined in Iowa; all of the State's metal production, such as raw steel, resulted from the processing of materials acquired from other domestic and foreign sources.

The following narrative information was provided by the Geological Survey Bureau[2] (GSB) of the Iowa Department of Natural Resources (IDNR). In 1997, Iowa recorded 239 licensed mineral producers operating 1,075 registered mineral production sites in a total of 97 counties. Of the 239 licensed producers, 9 had regional offices based outside of Iowa and 31 were Iowa county governments.

The 31 licensed county governments operated a total of 115 registered sites. Of the county-operated sites, 14 produced crushed stone, 100 produced sand and gravel, and 1 produced both crushed stone and sand and gravel. Six counties operated crushed stone quarries, and Fayette County, with nine registered sites, operated the greatest number of county licensed quarries. The other 26 county governments operated sand and gravel pits, and Kossuth County, with 12 registered sites, operated the greatest number of county licensed sand and gravel pits.

The greatest number of registered sites and the widest production distribution in any product class was in sand and gravel. Sand and gravel was produced in 88 counties from a total of 598 registered sites. Western Iowa, with its deeply buried bedrock, hosted the top 10 counties in terms of the number of sand and gravel sites. These top 10 western counties had 186 active sand and gravel pits representing slightly more than 30% of the total number of active sand and gravel pits statewide. Sac County, with 25 registered sand and gravel pits, had the greatest number of sand and gravel production sites of all the counties statewide. Hallett Materials Co. operated the greatest number of sand and gravel sites with a total of 54 sites spread across 22 counties.

Crushed stone (mined exclusively from sedimentary limestone or dolostone strata) was produced from 467 registered sites distributed across 66 counties. Of these 467 crushed stone sites, 8 were underground mine operations. Northeastern Iowa, with its readily accessible shallow bedrock, hosted 9 of the top 10 counties in terms of the number of crushed stone sites. These top 9 northeastern counties had 244 active quarries representing 52% of the total number of active crushed stone production sites statewide. Winneshiek County, with 40 registered quarries, had the greatest number of crushed stone sites of all counties statewide. Wendling Quarries, Inc. operated the greatest number of quarries with a total of 63 sites spread across 10 counties, while Martin Marietta Materials Inc. operated the greatest number of underground mines with 3 mines in 3 separate counties (Story, Webster, and Poweshiek Counties). Martin Marietta Aggregates of Southeast Iowa, Inc., a new licensee in 1997, assumed operational control over one underground limestone mine, the Durham Mine in Marion County, with its acquisition of production sites that had formerly been licensed to Kaser Corp. of Des Moines. One new underground limestone mine, the Atlantic Mine, was started in Cass County by Schildberg Construction Co., Inc. of Greenfield, IA. The mine will operate a 5-meter face, room and pillar style, in the Bethany Falls Limestone. This will be the first underground mine in the state to operate in the Pennsylvanian age limestones of southwest Iowa.

Crude gypsum was produced in 3 counties by 5 companies operating at a total of 13 sites. The United States Gypsum Co., having the largest number of production sites, operated 6 of these

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Robert McKay, Research Geologist, authored the text of minerals information provided by the Geological Survey Bureau of Iowa.

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13 sites, with 5 quarries in Webster County and 1 underground mine in Des Moines County. Webster County remained the leader in terms of the number of gypsum operations, with 11 quarries operated by 4 different companies. Georgia Pacific Corp., a longtime producer of gypsum rock in Webster County, discontinued mining operations at its Elkhorn Township Quarry because of inadequate reserves. The company also ceased buying gypsum rock from a 1996 local startup supplier, Don Grell, Co., owing to poor rock quality and insufficient supply. Georgia Pacific is currently supplying its board plant with gypsum rock from National Gypsum Co.'s Kaufmann-George Quarry in the northern part of the district.

Clay was produced at 13 sites in 6 counties by 7 different companies. Clay used in the manufacture of portland cement was mined at eight pits in Cerro Gordo and Scott Counties, and clay used for other clay products (primarily brick) was taken from four pits in Dallas, Woodbury, and Webster Counties. Clay material was mined at one registered site for fill material.

As part of its involvement in the USGS STATEMAP Program, the IDNR-GSB produced an Aggregate Resources Map of Linn County. This derivative map was one of several different types of maps produced by the GSB under its arrangement with the Linn County government. The map is available from the IDNR-GSB as an Open-File Map.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN IOWA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement, portland	2,340	161,000	2,390	187,000 e/	2,440	195,000 e/
Clays, common	322	1,590	478	1,180	479	1,110
Gemstones	NA	57	NA	481	NA	914
Gypsum, crude	2,240	13,800	2,090	12,800	2,030	14,400
Peat	5	77	W	W	W	W
Sand and gravel, construction	14,300	57,000	13,300	54,600	12,500	52,600
Stone, crushed	35,300	210,000	34,400	202,000	37,000	218,000
Combined value of cement (masonry), lime, sand and gravel (industrial), stone [dimension dolomite and sandstone (1995)], and values indicated by symbol W	XX	12,500	XX	11,100	XX	11,600
Total	XX	456,000	XX	470,000	XX	493,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
IOWA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone 2/	223	35,200	$210,000	$5.97	208	34,400	$202,000	$5.88
Dolomite	4	W	W	3.83	3	42	169	4.02
Miscellaneous stone	4	W	W	2.81	–	–	–	--
Total	XX	35,300	210,000	5.96	XX	34,400	202,000	5.88

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes limestone-dolomite reported with no distinction between the two.

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TABLE 3

IOWA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	201	$985	$4.90
Riprap and jetty stone	98	722	7.37
Filter stone	101	253	2.50
Other coarse aggregate	72	531	7.38
Coarse aggregate, graded:			
Concrete aggregate, coarse	997	6,010	6.03
Bituminous aggregate, coarse	329	1,950	5.92
Bituminous surface-treatment aggregate	201	1,200	5.96
Railroad ballast	W	W	6.88
Other graded coarse aggregate	31	34	7.55
Fine aggregate (-3/8 inch):			
Stone sand, concrete	W	W	2.24
Stone sand, bituminous mix or seal	103	496	4.82
Screening, undesignated	79	344	4.35
Other fine aggregate	W	W	3.80
Coarse and fine aggregates:			
Graded road base or subbase	1,540	8,420	5.47
Unpaved road surfacing	3,580	16,600	4.63
Terrazzo and exposed aggregate	10	61	6.10
Crusher run or fill or waste	218	646	2.96
Other coarse and fine aggregates	W	W	8.30
Other construction materials	343	1,720	5.02
Agricultural:			
Agricultural limestone	663	2,870	4.32
Other agricultural uses	(3/)	(3/)	2.22
Chemical and metallurgical:			
Cement manufacture	3070	22,900	7.47
Other specified uses not listed	(3/)	(3/)	2.00
Unspecified: 4/			
Actual	10,700	70,100	6.55
Estimated	12,100	66,300	5.48
Total	34,400	202,000	5.88

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."

1/ Includes dolomite, limestone, and limestone-dolomite.

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Withheld to avoid disclosing company proprietary data; included in "Total."

4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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Table 4
IOWA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 2		District 3		District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:										
Coarse aggregate (+1 1/2 inch) 3/	W	W	W	W	W	W	--	–	137	881
Coarse aggregate, graded 4/	W	W	W	W	673	4,250	--	--	450	2,290
Fine aggregate (-3/8 inch) 5/	W	W	W	W	W	W	--	--	52	223
Coarse and fine aggregate 6/	1,710	8,530	W	W	W	W	--	--	1,880	11,200
Other construction materials	689	4,440	214	1,200	2,100	7,120	--	--	--	--
Agricultural 7/	(8/)	(8/)	66	469	(8/)	(8/)	--	--	178	661
Chemical and metallurgical 9/	(8/)	(8/)	--	--	(8/)	(8/)	--	--	--	--
Other miscellaneous use 10/	–	–	–	--	(8/)	(8/)	–	--	–	--
Unspecified: 11/										
Actual	2,500 12/	16,500 12/	5,500	37,500	1,340	6,650	357	2,360	996	7,070
Estimated	1,760	9,950	–	–	5,040	27,000	4,650	27,800	651	1,590
Total	8,980	62,200	5,780	39,200	10,300	46,800	5,010	30,200	4,350	23,900

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Production reported in District 1 was included with "District 2" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
7/ Includes agricultural limestone and other agricultural uses.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes cement manufacture.
10/ Includes other specified uses not listed.
11/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.
12/ Includes unspecified within all districts.

TABLE 5
IOWA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	2,510	$10,800	$4.30
Plaster and gunite sands	48	252	5.25
Concrete products (blocks, bricks, pipe, decorative, etc.)	24	82	3.42
Asphaltic concrete aggregates and other bituminous mxtures	515	1,880	3.65
Road base and coverings 2/	2,290	6,670	2.92
Fill	621	1,650	2.65
Snow and ice control	62	263	4.24
Other miscellaneous uses 3/	51	429	8.41
Unspecified: 4/			
Actual	3,010	16,300	5.41
Estimated	4,160	16,300	3.92
Total or average	13,300	54,600	4.11

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes railroad ballast and roofing granules.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
IOWA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	554	2,270	594	3,120	112	382
Asphaltic concrete aggregates and road base materials 4/	993	2,800	921	3,150	934	2,600
Other miscellaneous uses 5/	3	29	28	264	11	104
Unspecified: 6/						
Actual	834	6,010	275	1,330	1,140	5,700
Estimated	1,110	3,570	268	1,160	2,270	9,510
Total	3,490	14,700	2,090	9,030	4,470	18,300

	District 4		District 6	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	752	2,810	572	2,550
Asphaltic concrete aggregates and road base materials 4/	170	436	466	1,470
Other miscellaneous uses 5/	--	--	9	31
Unspecified: 6/				
Actual	378	1,470	380	1,780
Estimated	222	958	292	1,120
Total	1,520	5,670	1,720	6,950

1/ Production reported in District 5 was included with "District 6" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Includes fill, road and other stabilization (cement and lime), and snow and ice control.
5/ Includes railroad ballast and roofing granules.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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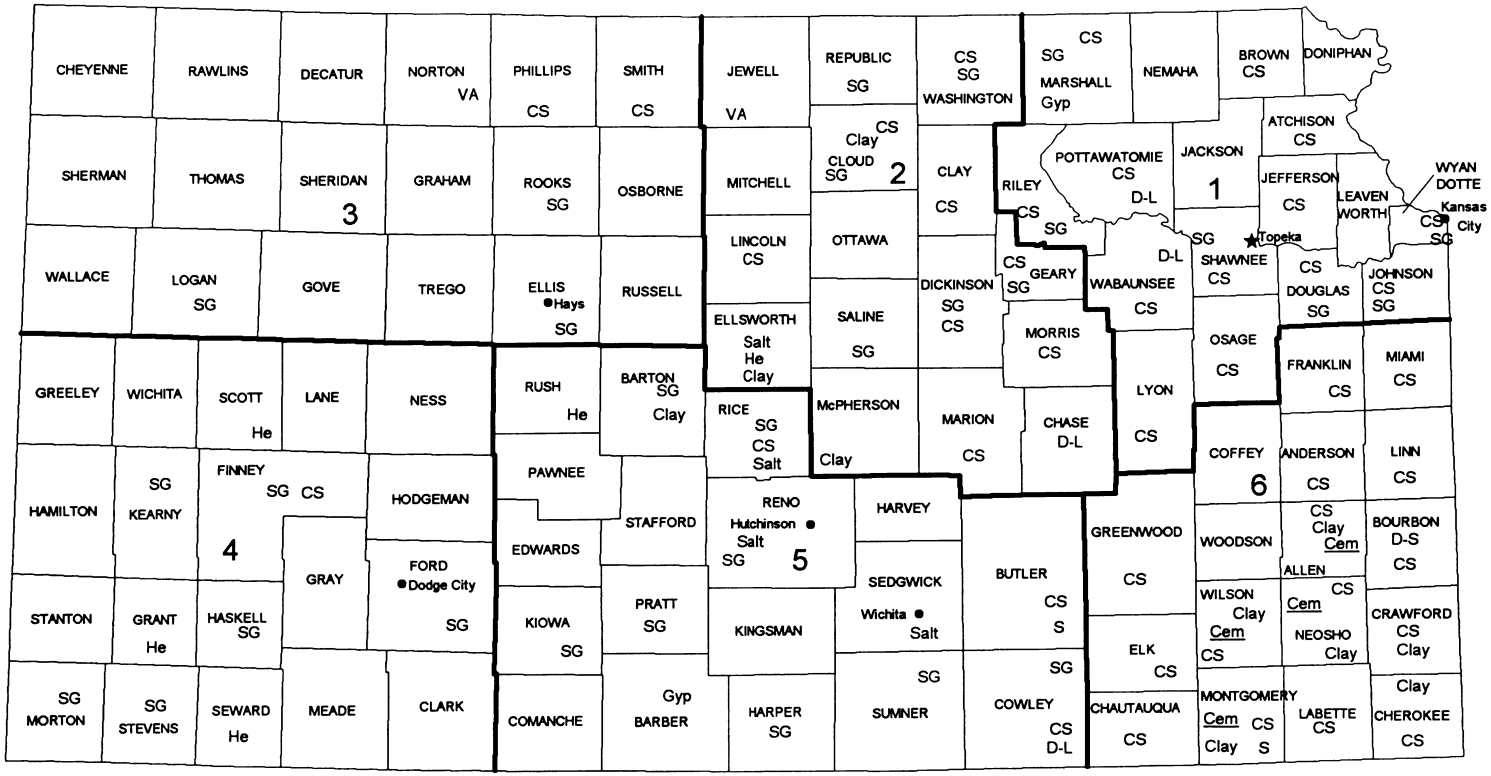
KANSAS



LEGEND

- State boundary
- County boundary
- ★ Capital
- • City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Cem	Cement plant
Clay	Clay
CS	Crushed stone
D-L	Dimension limestone
D-S	Dimension sandstone
Gyp	Gypsum
He	Helium
VA	Volcanic ash
S	Sulfur
Salt	Salt
SG	Sand and gravel

0 50 Kilometers

Source: Kansas Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF KANSAS

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Kansas Geoological Survey for collecting information on all nonfuel minerals.

In 1997, Kansas moved up in rank from 24th to 23d among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $547 million, a 3.2% increase from that of 1996. This followed a 6.4% increase from 1995 to 1996 (based on final 1996 data). The State accounted for about 1.5% of the U.S. total nonfuel mineral production value.

Portland cement, salt, crushed stone, and grade-A helium, were Kansas' leading nonfuel mineral commodities accounting for about 23%, 22%, 22%, and 20%, respectively, of the State's total nonfuel mineral production value. In 1997, many commodities contributed to Kansas' increase in nonfuel mineral value, but the increase mostly resulted from the rising values of crushed stone, portland cement, grade-A helium, and salt, in decreasing order of total increase *(table 1)*. Decreases in value occurred for common clays, construction sand and gravel, Fuller's earth, gypsum (crude), and pumice and pumicite. In 1996, most commodities increased in value, led by crushed stone, portland cement, and salt *(table 1)*. Small decreases occurred in common clays, dimension sandstone, masonry cement, grade-A helium, and pumice and pumicite.

The following narrative information was provided by the Kansas Geological Survey[2] (KGS). Sand and gravel dredging on the Kansas River was by far the most mentioned news item in the industrial minerals sector throughout 1997. At issue was the potential for recreation on the Kansas River and how river dredging might be affected. Throughout the year an interagency committee, the Kansas River Corridor Recreational Committee, addressed the issue of recreational potential. The committee, mandated by the legislature, was composed of five State agencies (Commerce and Housing, Water Office, Wildlife and Parks, Biological Survey, and Geological Survey). While all of the agencies were in favor of allowing some degree of recreation along the entire river, there were some differences as to whether there should be recreation zone(s) coexisting with commercial enterprises or restricted recreation zones that would exclude commercial activities. Near yearend, committee members decided to allow recreation on all parts of the river without selecting certain parts of the river for recreation only. However, at the last meeting of the year, all of the agencies except the KGS voted to set aside large parts of the river for recreation only.

Realizing at the outset the importance of possible impacts on the river-dredging industry, the KGS conducted its own study. The KGS study showed that since 1980, the population growth in the 10 counties bordering the Kansas River was twice as great as the whole State and now contained 40% of the State's population. Furthermore, population projections indicate that nearly 50% of Kansas residents will live in the 10-county area by the year 2025. The study also indicated factors such as a relatively narrow floodplain, considerable overburden, high land costs, and little availability of land, all of which favored the use of river dredges in the lower reaches of the Kansas River. The upper reaches of the river have a wider floodplain, more available land, lower land costs, and numerous locations with low overburden, all factors that favor pit or floodplain dredges. As a result, the KGS agreed with the concept of recreation zones, but not the large zones proposed that excluded possible future river dredging in areas of present high population density and future large population growth. The final committee recommendation did not define the area(s) of the Kansas River that should be restricted to recreation use alone. The interagency committee report will be submitted at the 1998 legislative session, and the KGS plans to submit their study as additional information for the Kansas Legislature to make their decision on this important issue.

Another important and controversial issue in western Kansas revolves around the scarcity of ground water in dredged pits along the Arkansas River floodplain, particularly the amount of water evaporation from the pits and the resulting effects on the watertable elevation. Representatives from the Kansas Aggregate Producers Association and the Equus Beds Groundwater Management District #2 have conducted several meetings in an attempt to define the extent of the problem and come up with a solution that satisfies all parties. That goal had not been met by yearend. A major problem is how to handle applications for dredging permits in areas where the ground water is already claimed. The task force hopes to draft legislation that would allow aggregate producers to have water rights.

Because of the healthy economy as well as a well-funded highway construction program, producers of construction-related commodities like building stone, cement, crushed stone, sand and gravel, etc. reported a very good year for their businesses, and they expect next year to be about the same.

Wamego Sand Co. (Wamego, Wabaunsee County) acquired

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities, for example, construction sand and gravel, crushed stone, and portland cement, estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html.

[2]David A. Grisafe, Industrial Minerals Specialist with the Kansas Geological Survey authored the text of minerals industry information submitted by that agency.

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Kershaw Ready-Mix Concrete and Sand Co. (Manhattan, Riley County) and changed Kershaw's name to Midwest Concrete Materials Co. Midwest operates three pit dredges and is also in the ready-mixed concrete business.

As part of the KGS's multiyear program remapping much of the State, county geology maps became available for Elk, Ness, and Stafford Counties. Active mapping programs are underway in many counties including Bourbon, Comanche, Ford, Greenwood, Hamilton, Kearny, Labette, Leavenworth, Marshall, Republic, Sedgwick, Wyandotte, and Wilson.

A new directory of industrial mineral producers was compiled using records from both the KGS and the State Conservation Commission (KGS, Open File Report 97-84). The new directory is arranged alphabetically by county and includes the commodity, name, address, and phone numbers as well the legal description for each operation. The directory is expected to be available on the Internet during early 1998 (http://www.kgs.ukans.edu).

A total of 85 open-file reports covering a variety of topics were completed at KGS during the year and are available in the Survey's library. Titles of 1996 open-file reports are on the Internet, and a 1997 list will be available during 1998. Among KGS publications of interest are (1) review of the building stones used in Wichita (Educational Series 11), (2) outcrop stratigraphy and depositional facies of the Chase Group (Lower Permian) in Kansas and southeastern Nebraska (Technical Series 6), and (3) current research in earth sciences (Bulletin 240). The KGS also has a series of short, issue-related Public Information Circulars (PIC). The PIC 6, published this year deals with sand, gravel, and crushed stone and its production and use in Kansas.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN KANSAS 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Cement:						
Masonry	31	2,650	24	2,240 e/	25	2,330 e/
Portland	1,730	109,000	1,730	120,000 e/	1,760	124,000 e/
Clays:						
Common	573	2,390	548	2,250	376	1,270
Fuller's earth	48	W	64	W	W	W
Gemstones	NA	W	NA	621	NA	1,000
Helium:						
Crude million cubic meters	30	26,600	W	W	W	W
Grade-A do.	53	105,000	53	104,000	54	108,000
Salt	2,770	113,000	2,950	118,000	3,100	121,000
Sand and gravel, construction	11,100	29,400	11,500	31,300	10,800	30,100
Stone:						
Crushed	20,400	95,800	22,100	110,000	23,600	118,000
Dimension 3/ metric tons	19,800	1,810	21,400	2,100	21,500	2,110
Combined value of gypsum (crude), pumice and pumicite, sand and gravel (industrial), stone (dimension sandstone), and values indicate symbol W	XX	12,200	XX	40,600	XX	39,300
Total	XX	498,000	XX	530,000	XX	547,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined value" figure.

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TABLE 2
KANSAS: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone 2/	107 r/	19,500 r/	$93,800 r/	$4.80	117	21,400	$108,000	$5.04
Sandstone and quartzite	3	W	W	2.32	2	W	W	2.38
Granite	1	W	W	3.47	1	W	W	3.56
Total	XX	20,400	95,800	4.69	XX	22,100	110,000	4.96

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes "Limestone-dolomite," reported with no distinction between the two.

TABLE 3
KANSAS: CRUSHED STONE SOLD OR USED
BY PRODUCERS IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	64	$284	$4.44
Riprap and jetty stone	161	887	5.51
Filter stone	318	1,910	6.01
Other coarse aggregate	107	652	6.09
Coarse aggregate, graded:			
Concrete aggregate, coarse	1,150	7,050	6.15
Bituminous aggregate, coarse	927	5,150	5.55
Bituminous surface-treatment aggregate	194	1,320	6.80
Railroad ballast	12	59	4.92
Other graded coarse aggregate	W	W	5.33
Fine aggregate (-3/8 inch):			
Stone sand, bituminous mix or seal	W	W	3.40
Screening, undesignated	538	1,370	2.55
Coarse and fine aggregate:			
Graded road base or subbase	1,370	6,600	4.83
Unpaved road surfacing	867	3,920	4.52
Terrazzo and exposed aggregate	W	W	6.70
Crusher run or fill or waste	367	2,210	6.01
Other coarse and fine aggregates	996	4,760	4.78
Other construction materials 3/	596	3,090	5.19
Agricultural limestone	216	939	4.35
Chemical and metallurgical, cement manufacture	1,990	7,950	4.00
Special, other fillers or extenders	81	611	7.54
Unspecified: 4/			
Actual	8,760	45,100	5.15
Estimated	3,420	15,800	4.62
Total	22,100	110,000	4.96

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Includes granite, limestone, limestone-dolomite, and sandstone and quartzite.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes waste material.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
KANSAS: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996,
BY USE AND DISTRICT 1/ 2/ 3/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 4/	259	1,650	W	W	--	--	W	W
Coarse aggregate, graded 5/	W	W	W	W	--	--	W	W
Fine aggregate (-3/8 inch) 6/	W	W	W	W	--	--	W	W
Coarse and fine aggregate 7/	W	W	W	W	172	277	2,850	13,900
Other construction materials 8/	2,010	12,400	1,960	8,790	--	--	407	2,210
Agricultural 9/	(10/)	(10/)	(10/)	(10/)	--	--	53	255
Chemical and metallurgical 11/	--	--	--	--	--	--	1,990	7,950
Special 12/	81	611	--	--	--	--	--	--
Unspecified: 13/								
Actual	(10/)	(10/)	(10/)	(10/)	--	--	2,940	13,200
Estimated	1,520	7,550	--	--	--	--	1,900	8,270
Total	8,700	49,000	3,110	14,600	172	277	10,100	45,800

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ No crushed stone was produced in District 4.
2/ Production reported in District 5 was included with "District 6" to avoid disclosing company proprietary data.
3/ Data are rounded to three significant digits; may not add to totals shown.
4/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
5/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
6/ Includes stone sand (bituminous mix or seal) and screening (undesignated).
7/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), terrazzo and exposed aggregate,and other coarse and fine aggregates.
8/ Includes waste material.
9/ Includes agricultural limestone.
10/ Withheld to avoid disclosing company proprietary data; included in "Total."
11/ Includes cement manufacture.
12/ Includes other fillers or extenders.
13/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
KANSAS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	2,520	$6,660.00	$2.64
Plaster and gunite sands	103	269	2.61
Concrete products (blocks, bricks, pipe, decorative, etc.)	11	89	8.09
Asphaltic concrete aggregates and other bituminous mixtures	1,640	5,170	3.15
Road base and coverings 2/	2,400	5,530	2.30
Fill	929	1,900	2.05
Snow and ice control	83	294	3.54
Roofing granules	23	75	3.26
Other miscellaneous uses	213	785	3.69
Unspecified: 3/			
Actual	1,620	5,040	3.11
Estimated	1,980	5,510	2.78
Total or average	11,500	31,300	2.72

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
KANSAS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	617	1,870	201	634	74	205
Asphaltic concrete aggregates and road base materials 3/	522	1,600	563	1,930	754	1,490
Other miscellaneous uses 4/	20	161	–	–	–	--
Unspecified: 5/						
Actual	1,100	3,520	40	96	19	54
Estimated	1,320	3,780	21	66	18	40
Total	3,580	10,900	825	2,730	865	1,790
	District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	230	685	1,510	3,620	--	--
Asphaltic concrete aggregates and road base materials 3/	1,260	3,090	1,940	4,750	15	39
Other miscellaneous uses 4/	--	--	215	700	--	--
Unspecified: 5/						
Actual	--	--	465	1,370	--	--
Estimated	217	617	401	1,000	--	--
Total	1,710	4,390	4,530	11,400	15	39

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill, road and other stabilization (cement and lime), and snow and ice control.
4/ Includes roofing granules.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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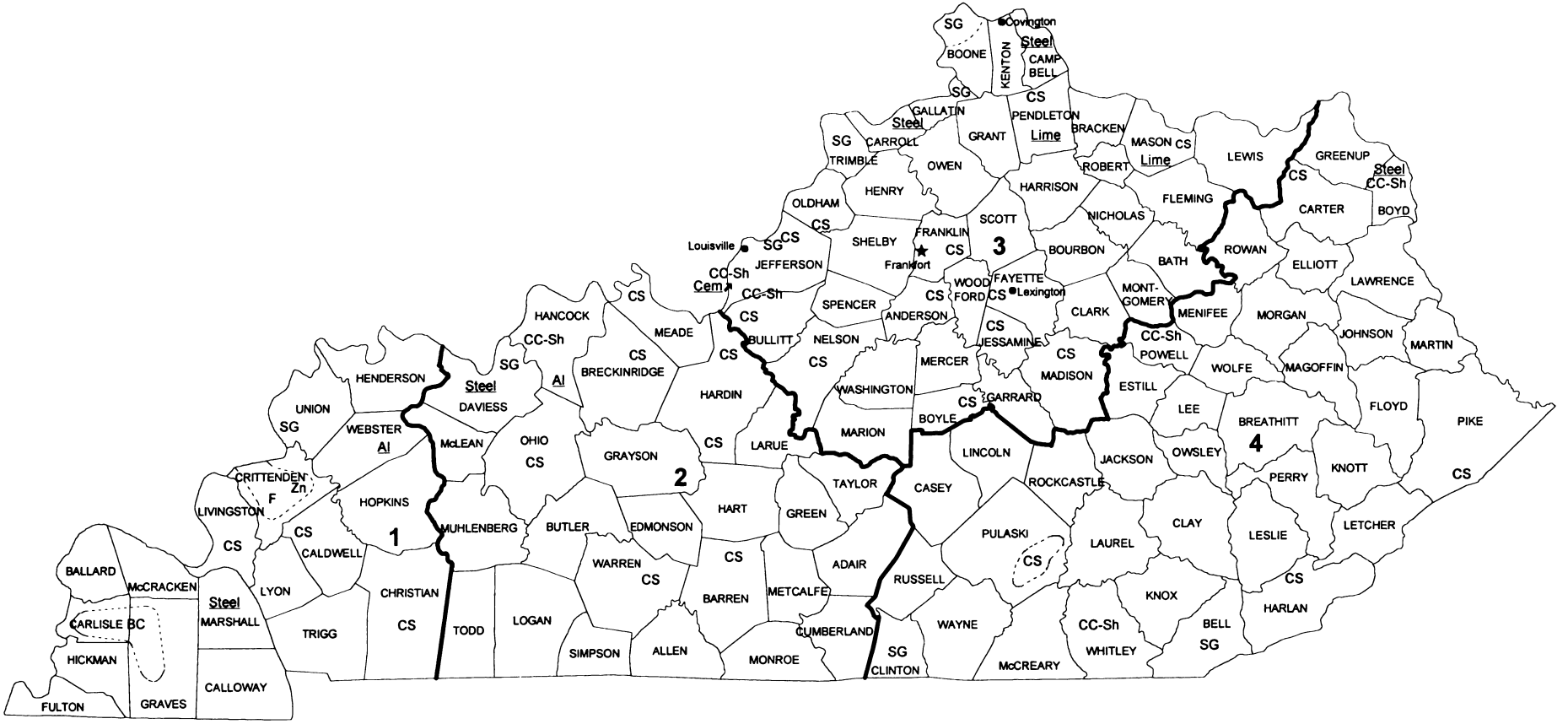
KENTUCKY



LEGEND

- State boundary
- County boundary
- ★ Capital
- ● City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

AI	Aluminum plant
BC	Ball clay
CC-Sh	Common clay and shale
Cem	Cement plant
CS	Crushed stone
F	Fluorspar
Lime	Lime plant
SG	Sand and gravel
Steel	Iron and steel plant
Zn	Zinc
⬭	Concentration of mineral operations

Source: Kentucky Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF KENTUCKY

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Kentucky Geological Survey for collecting information on all nonfuel minerals.

In 1997, Kentucky ranked 30th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The State was 31st in 1996. The estimated value for 1997 was $476 million, a nearly 8% increase from that of 1996. This followed a 2.3% increase from 1995 to 1996 (based on final 1996 data). In 1997, Kentucky reached the highest nonfuel mineral value reported in the State's history, surpassing the $400 million mark for the fifth time in the past 6 years. The State accounted for more than 1% of the U.S. total nonfuel mineral production value.

Crushed stone continued as the State's leading nonfuel mineral commodity in 1997, accounting for an estimated 57% of nonfuel mineral production value. Lime was second and portland cement was third. In recent years, Kentucky has been an industrial mineral-producing State. The last year in which any metal was mined in the State was 1990, when small quantities of zinc were mined. Kentucky's increase in nonfuel mineral value in 1997 resulted mostly from a $29-million, or about a 12%, increase in the value of crushed stone. Other mineral commodities increased in value except for gemstones (*table 1*). In 1996, the State's increase in value mostly resulted from increases in crushed stone and portland cement, moderated by a combined decrease in construction sand and gravel and a smaller decrease in ball clay.

Compared with USGS estimates of the quantities produced in the other 49 States during 1997, Kentucky remained one of the top three lime-producing States and ninth in crushed stone. The State rose from third to second (by value) in gemstones and from fourth to third in ball clays. Additionally, the State produced significant quantities of common clays. Primary aluminum and raw steel were produced from materials obtained from other domestic and foreign sources. Kentucky remained the Nation's second leading producer of primary aluminum.

The following narrative information was provided by the Kentucky Geological Survey[2] (KGS). In the Western Kentucky Fluorspar District, zinc was the target for exploratory drilling in Crittenden County. Savage Zinc Co. purchased USX Corp.'s idle fluorspar mill near Salem. No exploration activity was reported from the State's central and south-central mineral districts.

Elf Atochem North American, Inc. completed construction of a HFC-134a plant in Calvert City, Marshall County. The plant, with a capacity of 18,100 metric tons, will produce refrigerants for automobiles, refrigerators, and freezers, principally in the North American market. Fluorspar is one of the raw materials used to manufacture these refrigerants.

Corhart Refractories Corp. finished constructing a new $12 million plant in Louisville, Jefferson County, for the manufacture of Cruciform, a new product, used to line glass furnaces.

Sterling Materials Co. is in the process of developing an underground limestone mine in Gallatin County in northern Kentucky. Drilling and property acquisition were completed during 1997. Aggregates will be produced from the High Bridge Group (Ordovician), a major aggregates source in central Kentucky.

Dravo Lime Co. completed construction of a new 318,000-metric-ton-per-year preheater rotary kiln at its Maysville Division lime plant in Mason County. The Maysville plant is the second largest lime plant in North America.

A $50-million expansion of Kosmos Cement Co.'s cement plant near Louisville was announced by its joint owners, Southdown Inc. and the Lone Star Industries. Annual production capacity will be increased from 787,000 metric tons to 1.26 million tons.

Louisville Gas and Electric Co. (LG&E) and the United States Gypsum Co. announced that, beginning in 1999, U.S. Gypsum annually will purchase more than 450,000 tons of synthetic gypsum to be produced at LG&E's Mill Creek powerplant in Jefferson County. The gypsum will be a byproduct of Mill Creek's limestone-based flue-gas desulfurization system, which will undergo a $25 million modification. The plant's scrubber product currently is landfilled.

Martin Marietta Materials purchased the Fredonia quarry in Caldwell County from Rock Dust Products. The Fredonia operation produces chemical-grade stone from the Saint Genevieve Limestone. The Elmo Greer and Sons Quarry in Pulaski County was purchased by the Kentucky Stone Co. The Greer site is on the east side along the Kentucky Highway 80 corridor leading into the Eastern Kentucky Coal Field, a region mainly devoid of sources for crushed stone.

Benchmark Material's Division of Cornerstone Construction and Materials Inc. (CCM) chose Louisville as its midwest regional office. CCM's Midwest region includes the Kentucky Stone Co. and the France Stone Co.

American Aggregates Corp. had been attempting to open an underground mine in Boone County in northern Kentucky, but the county government was delaying making a decision about the

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. Construction sand and gravel and crushed stone estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html.

[2]Garland Dever, Geologist, submitted the text of information provided by the Kentucky Geological Survey.

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request. As a result of a lawsuit filed by American Aggregates to force a decision, the county planning commission in late 1997 proposed regulations for subsurface mining in the county. At yearend, the regulations were pending before Boone County Fiscal Court.

Nugent Sand Co. proposed developing a sand distribution facility along the Ohio River near West Point, Hardin County, to serve Hardin and Meade Counties and southwestern Jefferson County. The proposed facility was approved by Hardin County and at yearend, a decision by the Corps of Engineers was pending. The Corps must approve the project because of its location on a navigable river.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN KENTUCKY 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Ball	117	W	70	W	82	6,070
Common	786	3,430	823	3,680	739	3,790
Gemstones	NA	W	NA	5,910	NA	4,580
Sand and gravel, construction	8,710	31,700	7,310	25,600	7,890	28,300
Stone, crushed 3/	54,700	230,000	58,500	243,000	64,000	272,000
Combined value of cement, lime, stone [crushed (1995), crushed sandstone (1996-97)], and values indicated by symbol W	XX	167,000	XX	164,000	XX	161,000
Total	XX	432,000	XX	442,000	XX	476,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined value" data.

TABLE 2
KENTUCKY: CRUSHED STONE SOLD OR USED BY PRODUCERS, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	90 r/	55,500 r/	$234,000 r/	$4.22 r/	92	58,500	$243,000	$4.15
Sandstone	--	--	--	--	(2/)	(2/)	(2/)	(2/)
Total	XX	55,500 r/	234,000 r/	4.22 r/	XX	58,500	243,000	4.15

r/ Revised. XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excludes sandstone from State total to avoid disclosing company proprietary data.

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TABLE 3
KENTUCKY: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996,
BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	582	$3,000	$5.15
Filter stone	529	2,690	5.09
Other coarse aggregate 3/	467	2,410	5.15
Coarse aggregate, graded:			
Concrete aggregate, coarse	3,330	15,600	4.69
Bituminous aggregate, coarse	4,350	21,000	4.82
Bituminous surface-treatment aggregate	1,120	5,860	5.23
Railroad ballast	186	961	5.17
Other graded coarse aggregate	1,380	7,640	5.53
Fine aggregate (-3/8 inch):			
Stone sand, concrete	198	1,220	5.97
Stone sand, bituminous mix or seal	1,330	5,790	4.34
Screening, undesignated	326	1,980	6.06
Other fine aggregate	320	1,780	5.56
Coarse and fine aggregate:			
Graded road base or subbase	4,570	20,000	4.37
Unpaved road surfacing	2,170	9,740	4.48
Crusher run or fill or waste	640	2,780	4.34
Other coarse and fine aggregate	1,280	6,470	5.06
Other construction materials 4/	19	25	1.32
Agricultural:			
Agricultural limestone	962	4,000	4.15
Poultry grit and mineral food	8	132	16.50
Other agricultural uses	4	46	11.50
Chemical and metallurgical:			
Cement manufacture	(5/)	(5/)	2.63
Lime manufacture	(5/)	(5/)	1.10
Sulfur oxide removal	(5/)	(5/)	3.92
Special:			
Mine dusting or acid water treatment	32	493	7.65
Other fillers or extenders	132	1,230	9.34
Unspecified: 6/			
Actual	18,200	75,500	4.16
Estimated	10,800	43,700	4.05
Total	58,500	243,000	4.15

1/ Includes limestone; excludes sandstone from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits except unit value; may not add to totals shown.
3/ Includes macadam.
4/ Includes waste material.
5/ Withheld to avoid disclosing company proprietary data; included in "Total."
6/ Includes production reported without a breakdown by end use and with estimates for norespondents.

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TABLE 4
KENTUCKY: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 3/	(4/)	(4/)	(4/)	(4/)	469	2,450	851	4,570
Coarse aggregate, graded 5/	(4/)	(4/)	(4/)	(4/)	4,010	22,600	3,400	16,800
Fine aggregate (-3/8 inch) 6/	(4/)	(4/)	(4/)	(4/)	709	3,860	897	4,260
Coarse and fine aggregate 7/	(4/)	(4/)	(4/)	(4/)	3,430	17,100	2,360	11,000
Other construction materials 8/	--	--	--	--	19	25	--	--
Agricultural 9/	(4/)	(4/)	(4/)	(4/)	(4/)	(4/)	(4/)	(4/)
Chemical and metallurgical 10/	(4/)	(4/)	(4/)	(4/)	(4/)	(4/)	--	--
Special 11/	(4/)	(4/)	--	--	--	--	(4/)	(4/)
Unspecified: 12/								
Actual	15,200	61,500	--	--	2,920	14,000	--	--
Estimated	169	694	2,630	10,800	5,020	20,800	2,980	11,300
Total	17,400	71,700	9,530	35,700	21,000	86,900	10,600	48,600

1/ Excludes sandstone from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Withheld to avoid disclosing company proprietary data; included in "Total."
5/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and othergraded coarse aggregate.
6/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
7/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
8/ Includes waste material.
9/ Includes agricultural limestone, poultry grit and material food, and other agricultural uses.
10/ Includes cement manufacture, lime manufacture, and sulfur oxide removal.
11/ Includes mine dusting or acid water treatment, and other fillers or extenders.
12/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
KENTUCKY: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996, BY MAJOR USE CATEGORY 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 3/	1,260	$4,720	$3.73
Concrete products (blocks, bricks, pipe, decorative, etc.)	101	407	4.03
Asphaltic concrete aggregates and other bituminous mixtures	403	1,360	3.37
Road base and coverings	103	404	3.92
Fill	404	1,270	3.15
Unspecified: 4/			
Actual	1,130	3,930	3.46
Estimated	3,900	13,500	3.46
Total or average	7,310	25,600	3.50

1/ To avoid disclosing company proprietary data, no district tables were produced for 1996.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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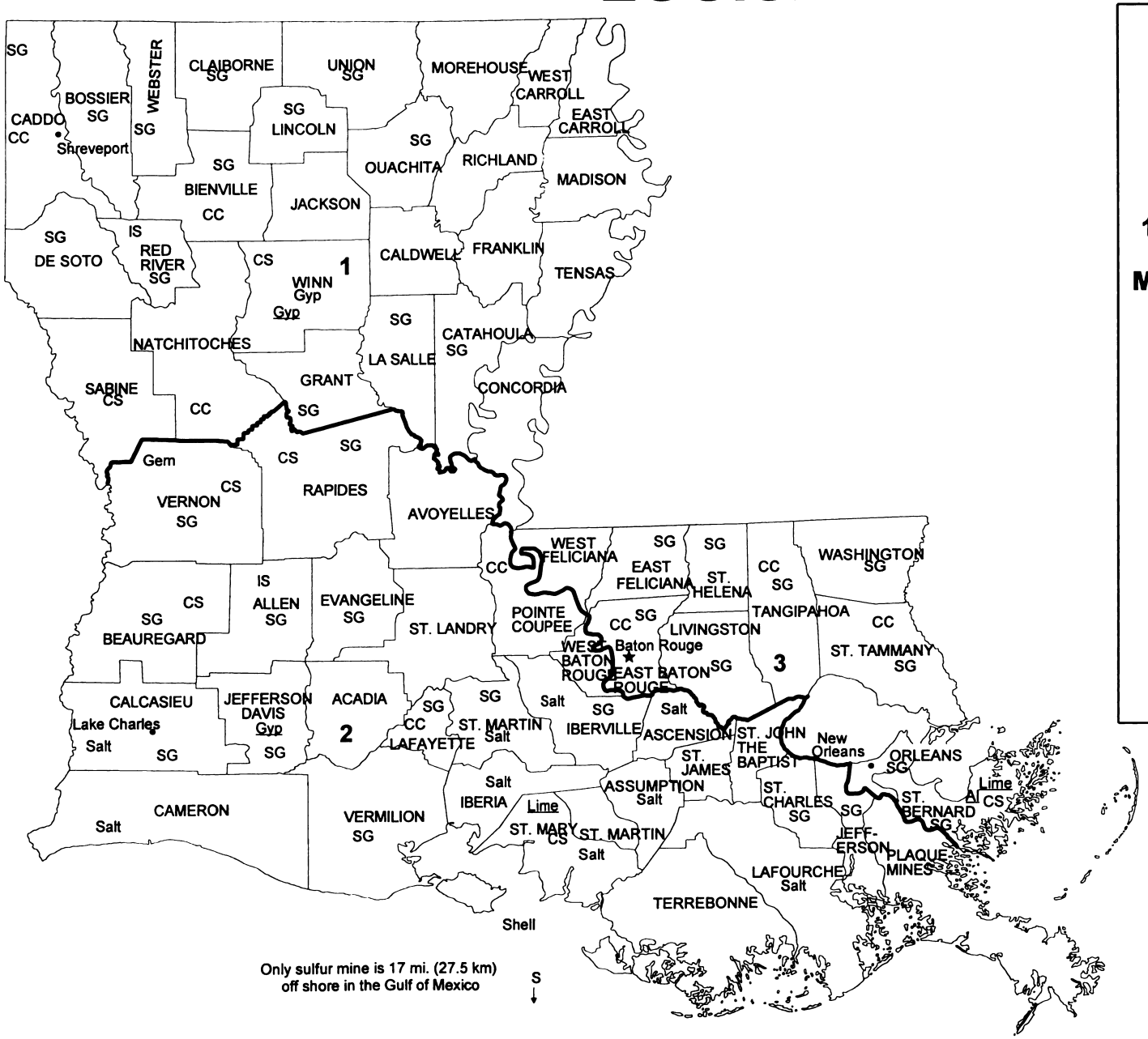
LOUISIANA



LEGEND

- State boundary
- County boundary
- ★ Capital
- • City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Al	Aluminum plant
CC	Common clay
CS	Crushed stone
Gem	Gemstones
Gyp	Gypsum
Gyp	Gypsum plant
IS	Industrial sand
Lime	Lime plant
S	Sulfur
Salt	Salt
SG	Sand and gravel
Shell	Shell

Source: Louisiana Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF LOUISIANA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Louisiana Geological Survey for collecting information on all nonfuel minerals.

In 1997, Louisiana ranked 35th in the Nation in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The State was 33d in 1996. The estimated value for 1997 was $379 million, about a 3.6% decrease from that of 1996. This followed a 9.4% decrease from 1995 to 1996 (based on final 1996 data). The State accounted for about 1% of the U.S. total nonfuel mineral production value.

Louisiana's leading nonfuel mineral is salt, accounting for about 45% of the State's nonfuel mineral value in 1997. When included as part of Louisiana's mineral production, sulfur is the State's second-leading mineral commodity. All current sulfur production comes from a mine 27 kilometers off the Louisiana coast. Because of the mine's location, the State does not receive severance tax income or mineral production royalties; instead, they are collected by the Federal Government. Consequently, since 1991 the State and the Louisiana Geological Survey (LGS) do not consider the sulfur production cited in table 1 under "Combined value" as being part of Louisiana's nonfuel mineral production. The USGS attributes this offshore sulfur production to Louisiana because it is the State nearest to the sulfur mine and Freeport Sulphur Co., the company that operates the mine, is based in New Orleans.

In 1997, decreases in the values of crushed stone, salt, and construction sand and gravel accounted for most of the States's drop in nonfuel mineral value. Compared with 1996, mineral commodity values that increased in 1997 were those of Frasch sulfur, gemstones, common clays, miscellaneous crushed stone, and lime. Mineral commodity valuesthat decreased were those of industrial sand and gravel and crude gypsum. In 1996, a more than 20% drop in sulfur production value accounted for most of the State's decreased nonfuel mineral value. Based on USGS estimates of the quantities produced in the 50 States during 1996, Louisiana remained the leading State in the Nation in salt and sulfur production.

The following narrative information was provided by the LGS.[2] Cargill Inc., based in Minneapolis, MN, agreed in August 1996 to acquire most of Akzo Nobel NV of the Netherlands' North American salt business. After getting federal antitrust clearance in April 1997 for its $190 million acquisition, Cargill acquired Akzo Nobel's salt mine at Avery Island in Iberia Parish. The Avery Island Mine is one among Akzo properties across the United States that Cargill acquired. Cargill already owns an evaporated salt plant in Breaux Bridge.

By means of House bill 2353, the Louisiana Legislature transferred the LGS, a nonregulatory component of the State Department of Natural Resources, to Louisiana State University effective July 1, 1997.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. Construction sand and gravel and crushed stone estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing and specific commodity reports may also be retrieved over the Internet at: http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Syed M. Haque, Physical Scientist at the LGS, authored the text of Louisiana minerals industry information submitted by the LGS.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN LOUISIANA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays, common	384	548	382	548	481	887
Gemstones	NA	175	NA	136	NA	667
Salt	14,700	177,000	15,500	175,000	15,600	171,000
Sand and gravel:						
Construction	11,300	50,200	11,500	53,200	10,700	50,700
Industrial	572	10,500	706	12,100	566	10,900
Stone, crushed 3/	2,540	26,700	2,290	23,900	1,600	17,000
Combined value of gypsum (crude), lime, stone [crushed miscellaneous (1996-97), crushed shell and miscellaneous (1995)], sulfur (Frasch)	XX	169,000	XX	128,000	XX	128,000
Total	XX	434,000	XX	393,000	XX	379,000

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined value" data.

TABLE 2
LOUISIANA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 2/				1996 3/			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Sandstone	16	2,540	$26,700	$10.50	13	2,290	$23,900	$10.44

1/ Data are rounded to three significant digits, except unit value.
2/ Excludes miscellaneous stone and shell from State total to avoid disclosing company proprietary data.
3/ Excludes miscellaneous stone from State total to avoid disclosing company proprietary data.

TABLE 3
LOUISIANA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Construction aggregate 3/	239	$1,780	$7.46
Unspecified: 4/			
Actual	1,950	21,600	11.05
Estimated	98	518	5.29
Total	2,290	23,900	10.44

1/ Includes sandstone; excludes miscellaneous stone from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes bituminous aggregate (coarse) and stone sand (bituminous mix or seal).
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
LOUISIANA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 2/	4,030	$20,500	$5.08
Asphaltic concrete aggregates and other bituminous mixtures	447	2,150	4.81
Road base and coverings 3/	830	4,150	5.00
Fill	914	1,920	2.10
Filtration	16	168	10.50
Unspecified: 4/			
Actual	3,570	16,900	4.75
Estimated	1,730	7,450	4.31
Total or average	11,500	53,200	4.62

1/ Data are rounded to three significant digits except value per ton; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement).
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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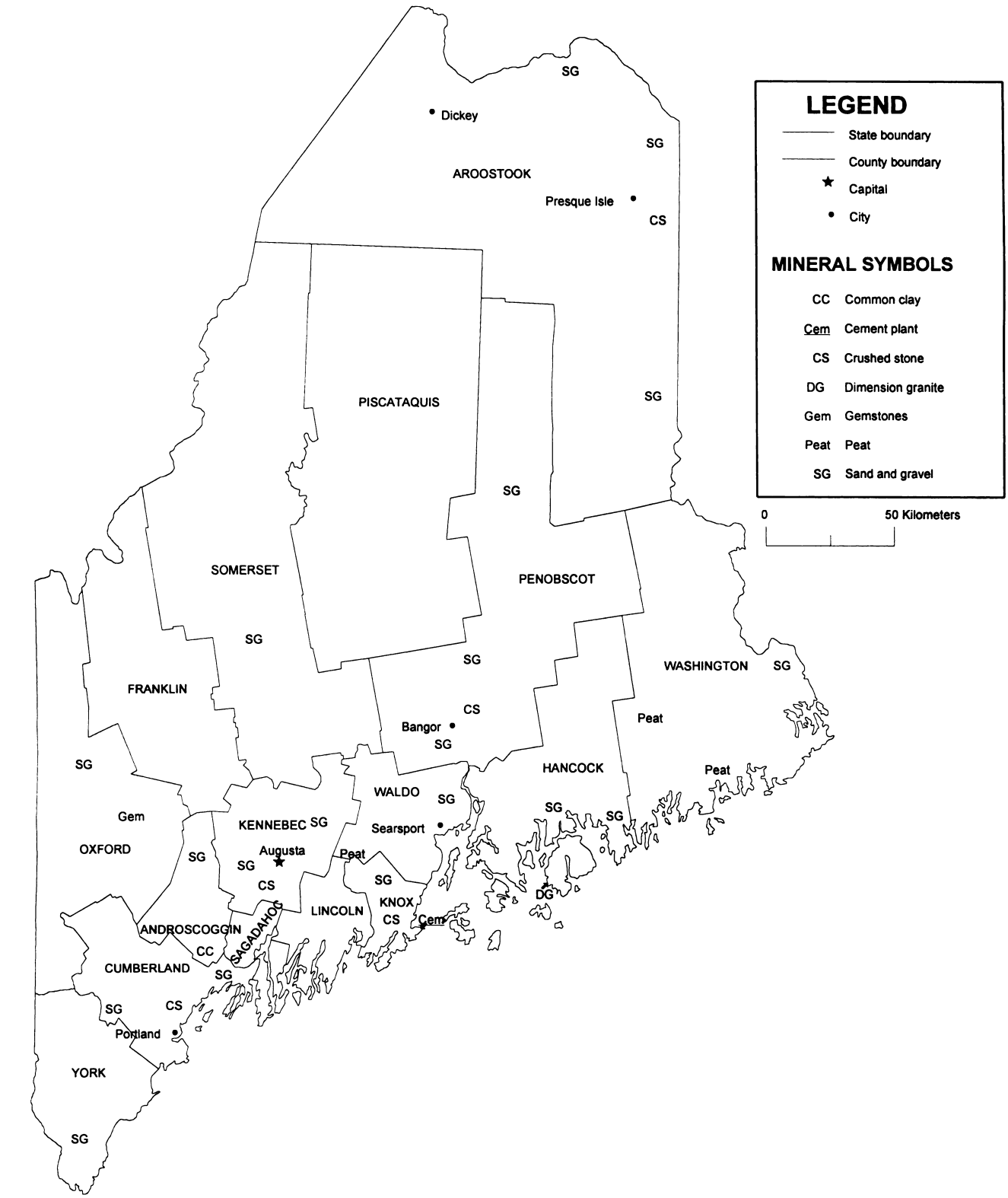
MAINE



Source: Maine Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF MAINE

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Maine Geoological Survey for collecting information on all nonfuel minerals.

In 1997, Maine rose to 44th from 45th in the Nation in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $88.2 million, nearly a 29% increase from that of 1996. This followed a 1.5% increase from 1995 to 1996. The State accounted for somewhat less than 0.5% of the U.S. total nonfuel mineral production value. Maine's increase in value in 1997 mostly resulted from a $16.3 million increase in the value of construction sand and gravel together with smaller increases in crushed stone and portland cement (*table 1*). There was also a small increase in peat production; all other values remained virtually the same. In 1996, the mineral commodities mostly responsible for the State's increase were portland cement and construction sand and gravel.

The following narrative information was provided by the Maine Geological Survey[2] (MGS). The most significant new development in the Maine mineral industry was the submission of a formal application by NNM Resources, Inc., a wholly owned subsidiary of Black Hawk Mining Inc., to open a gold and silver mine at NNM's Bald Mountain deposit in the T12 R8 section of Aroostook County. The application, submitted jointly to the Maine Land Use Regulation Commission (LURC) and the Maine Department of Environmental Protection (MDEP) in December 1997, is to mine the gossan cap, estimated at 1.1 million metric tons of 4.5 grams per ton gold and 101 grams per ton silver. The gossan cap overlies the main ore body estimated to contain 32 million tons of massive sulfide (zinc, copper, gold, and silver). The application calls for the metals to be extracted on-site by a vat leaching process. Some baseline information and baseline monitoring plans for the site were developed in the 1980's and early 1990's by Boliden Resources, Inc., the previous leaseholder. New baseline monitoring data, related mainly to groundwater, were collected in 1996-97 and submitted by NNM Resources with the current application. The Bald Mountain Project represents the first mining application to the State under revised mining rules adopted in 1991. Before a mine can be opened, several stages in the process must be achieved, including technical reviews by LURC and MDEP staff, with input from a variety of groups including the Maine Department of Inland Fisheries and Wildlife, the MGS, and the general public. The proposed mine site, about 24 kilometers west of Ashland, is in an unorganized township; therefore it falls under the jurisdiction of LURC.

At the Alder Pond copper-zinc-lead deposit in Somerset County, northwestern Maine, Prospectors Alliance Corporation of Toronto in joint venture with International Larder Minerals, Inc., completed their 1996-97 drilling program of 33 vertical drill holes, which focused on the main zone of the deposit. Drilling results from Prospectors Alliance reported reserves for the main zone of 508,000 tons averaging 2.2% copper, 0.5% lead, 9.0% zinc, and 103 grams per ton silver. No new drilling was reported in the south zone of the deposit, previously estimated by BHP Minerals to host 907,000 tons of ore.

Geologists from the USGS continued their study of field exposures and drill cores from the Bald Mountain deposit of northern Maine to determine the origin of the deposit. USGS Open-File Report OF 97-746 describes the mineral paragenesis in seven stages of mineralization, related mainly to Ordovician sea floor volcanism and subsurface hydrothermal activity. Preliminary results of related aspects were presented in abstracts at the 1998 Northeastern Section meeting of the Geological Society of America.

Interest in Maine minerals among both amateur and professional collectors remained strong in 1997. Activity in several areas of southern and southwestern Maine produced fine specimens of wodgingite, molybdenite, spodumene, heterosite, and foot-long andalusite crystals. An economically significant strike occurred in the Berry Quarry of East Poland, which yielded a rich pocket of green gem tourmalines. A new crushed-rock quarry in West Baldwin exposed a sphalerite-triphyllite-columbite-beryl pegmatite. This type of pegmatite is unusual for the area south of the Sebago pluton, which contains many common pegmatites with muscovite, garnet, and schorl.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Henry Berry, Physical Geologist, authored the text of minerals industry information submitted by the Maine Geological Survey.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MAINE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Gemstones	NA	305	NA	223	NA	227
Peat	15	845	18	960	15	1,000
Sand and gravel, construction	6,420	26,900	6,440	27,500	10,000	43,800
Stone, crushed	3,110	16,100	2,760	14,800	3,100	17,200
Combined value of cement, clays (common), stone (dimension granite)	XX	23,500	XX	25,000	XX	26,000
Total	XX	67,600	XX	68,600	XX	88,200

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
MAINE: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	6	1,590	$7,910	$4.96	6	1,410	$7,410	$5.25
Calcareous marl	1	W	W	11.43	--	--	--	--
Granite	4 r/	W	W	5.22 r/	3	W	W	5.04
Quartzite	1	W	W	5.65	1	W	W	5.79
Slate	2	W	W	6.61	2	W	W	7.11
Traprock	2	W	W	5.52	2	W	W	5.77
Miscellaneous stone	2 r/	W	W	3.88 r/	1	W	W	3.98
Total	XX	3,110	16,100	5.17	XX	2,760	14,800	5.38

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

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TABLE 3
MAINE: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch), other coarse aggregate 3/	93	$511	$5.49
Coarse aggregate, graded; concrete aggregate, coarse	146	1,110	7.58
Coarse and fine aggregate:			
Graded road base or subbase	214	966	4.51
Other coarse and fine aggregates 4/	377	2,170	5.76
Agricultural limestone	8	123	15.38
Other specified uses not listed 5/	661	2,460	3.72
Unspecified: 6/			
Actual	164	1,340	8.15
Estimated	1,100	6,170	5.63
Total	2,760	14,800	5.38

1/ Includes granite, limestone, miscellaneous stone, quartzite, slate, and traprock.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes filter stone and riprap and jetty stone.
4/ Includes bituminous aggregate (coarse), railroad ballast, and screening (undesignated).
5/ Includes cement and lime manufacture.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 4
MAINE: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996, BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	560	$2,510	$4.48
Concrete products (blocks, bricks, pipe, decorative, etc.)	(2/)	1	6.91
Asphaltic concrete aggregates and other bituminous mixtures	558	5,020	9.00
Road base and coverings 3/	1,430	5,550	3.87
Fill	609	1,440	2.37
Snow and ice control	774	2,180	2.82
Other miscellaneous uses	233	654	2.81
Unspecified: 4/			
Actual	168	751	4.47
Estimated	2,110	9,400	4.46
Total or average	6,440	27,500	4.27

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Less than 1/2 unit.
3/ Includes road and other stabilization (cement).
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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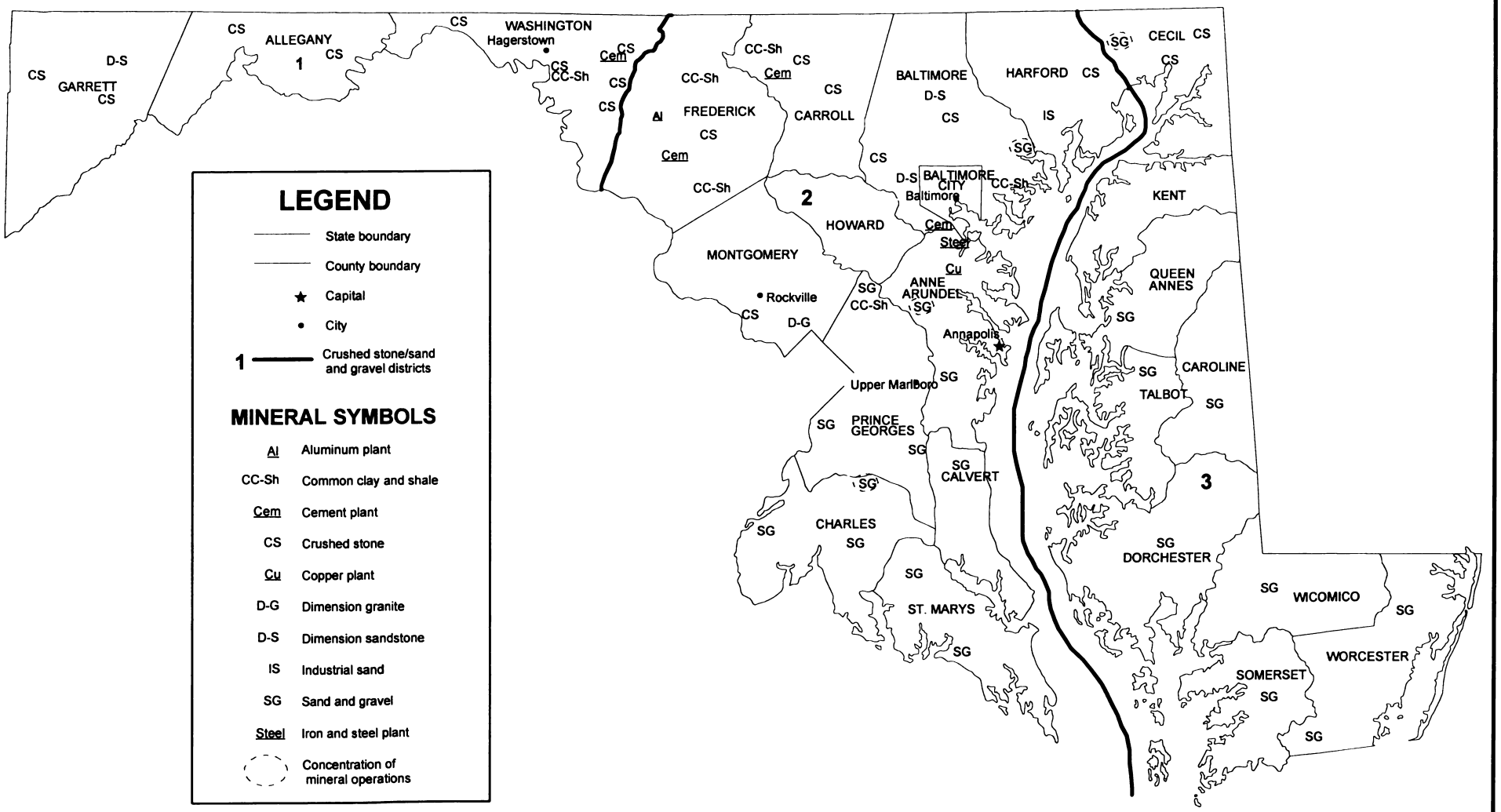
MARYLAND



Source: Maryland Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF MARYLAND

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Maryland Geoological Survey for collecting information on all nonfuel minerals.

In 1997, Maryland climbed in rank to 33d from 36th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $401 million, a nearly 21% increase from the $332 million of 1996. The State accounted for 1% of the U.S. total nonfuel mineral production value.

Crushed stone remained Maryland's leading nonfuel mineral commodity. Based on the State's 1997 total value shown in table 1, crushed stone accounted for 49% of it, followed by portland cement, 26%, and construction sand and gravel, 18%. Whereas nearly all nonfuel minerals increased in value in 1997 (industrial sand and gravel remained the same), crushed stone with a gain of $53 million, or 37%, and construction sand and gravel up $11.3 million, or 18%, led the State's increase in total nonfuel mineral production value.

All nonfuel minerals mined in Maryland were industrial minerals; all metals production, in particular primary aluminum and raw steel, was processed from materials received from foreign and other domestic sources. Based on preliminary figures, Maryland was ninth in the Nation in the production of primary aluminum.

The following narrative information was provided by the Maryland Department of the Environment[2] (MDE). The MDE received an application from The Arundel Corp. for a new limestone quarry in Carroll County. The company applied for a new 51.4-hectare quarry that will produce limestone for construction aggregate. Arundel also had been involved in a very contentious permit expansion for their Havre de Grace Quarry in Harford County. That request to add an additional 40.5 hectares at Havre de Grace was withdrawn.

A mineral deposit was discovered in Blue Mount Quarry, in north central Baltimore County. The quarry has operated for several decades as a dimension and limited crushed stone operation. During reserve estimating activities, a previously defined "soft rock" was confirmed to be high chemical quality talc. This deposit does not contain asbestos, as do other talc deposits that have been discovered in the region. The permittee, now evaluating the prospect, has a preliminary reserve estimate of more than 900,000 metric tons of talc.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]C. Edmon Larrimore, Chief of the Minerals, Oil and Gas Division, Maryland Department of the Environment authored the text of information submitted by that agency.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MARYLAND 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement, portland	1,670	101,000	1,610	99,400 e/	1,640	103,000 e/
Clays, common	278	943	304	874	293	920
Gemstones	NA	1	NA	1	NA	1
Sand and gravel, construction	9,700	61,700	9,700	61,400	11,200	72,700
Stone:						
Crushed	24,200	158,000	22,400 3/	142,000 3/	25,000 3/	195,000 3/
Dimension metric tons	20,700	2,260	19,800	2,210	19,900	2,220
Combined value of other industrial minerals	XX	(4/)	XX	26,000	XX	26,400
Total	XX	324,000 5/	XX	332,000	XX	401,000

e/ Estimated. p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined value" data.
4/ Value excluded to avoid disclosing company proprietary data.
5/ Partial total, excludes values that must be concealed to avoid disclosing company proprietary data.

TABLE 2
MARYLAND: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	19	15,500	$105,000	$6.79	21	17,400	$111,000	$6.42
Granite	4	4,960	29,400	5.93	3	4,880	29,500	6.04
Traprock	2	W	W	6.31	(2/)	(2/)	(2/)	(2/)
Marble	2	W	W	6.21	(2/)	(2/)	(2/)	(2/)
Sandstone	3	191	1,430	7.46	3	196	1,110	5.64
Total	XX	24,200	158,000	6.54	XX	22,400	142,000	6.33

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excludes marble and traprock from State total to avoid disclosing company proprietary data.

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TABLE 3
MARYLAND: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch), riprap and jetty stone	300	$2,490	$8.31
Coarse aggregate, graded:			
Concrete aggregate, coarse	856	5,910	6.90
Bituminous aggregate, coarse	543	3,490	6.42
Bituminous surface-treatment aggregate	277	2,040	7.37
Railroad ballast	W	W	6.42
Other graded coarse aggregate	W	W	6.26
Fine aggregate (-3/8 inch):			
Stone sand, concrete	40	410	10.25
Stone sand, bituminous mix or seal	W	W	5.10
Screening, undesignated	36	260	7.22
Other fine aggregate	72	400	5.56
Coarse and fine aggregates:			
Graded road base or subbase	1,270	7,980	6.31
Crusher run or fill or waste	501	2,740	5.46
Other coarse and fine aggregates 3/	2,100	8,020	3.82
Agricultural limestone	(4/)	(4/)	6.53
Chemical and metallurgical, cement manufacture	(4/)	(4/)	2.47
Special, whiting or whiting substitute	(4/)	(4/)	77.71
Unspecified: 5/			
Actual	13,500	88,400	6.54
Estimated	976	2,600	2.67
Total	22,400	142,000	6.33

W Withheld to avoid disclosing company proprietary data; included with "Other coarse and fine aggregates."
1/ Includes granite, limestone, and sandstone; excludes marble and traprock from State total to avoid disclosing proprietary data.
2/ Data are rounded to three significant digits except unit value; may not add to totals shown.
3/ Includes roofing granules and waste material.
4/ Withheld to avoid disclosing company proprietary data; included in "Total."
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
MARYLAND: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Construction aggregates:				
Coarse aggregate (+1 1/2 inch) 3/	W	W	W	W
Coarse aggregate, graded 4/	W	W	W	W
Fine aggregate (-3/8 inch) 5/	W	W	W	W
Coarse and fine aggregate 6/	1,780	9,800	4,210	23,900
Agricultural 7/	(8/)	(8/)	--	--
Chemical and metallurgical 9/	--	--	(8/)	(8/)
Special 10/	--	--	(8/)	(8/)
Unspecified: 11/				
Actual	1,410	5,600	12,100	82,800
Estimated	(8/)	(8/)	--	--
Total	4,170	18,000	18,300	124,000

W Withheld to avoid disclosing company proprietary data; included with "Other coarse and fine aggregate."
1/ Production reported in District 3 was included with "District 2" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes riprap and jetty stone.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, crusher run (select material or fill), other coarse and fine aggregates, roofing granules, and waste material.
7/ Includes agricultural limestone.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes cement manufacture.
10/ Includes whiting or whiting substitute.
11/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
MARYLAND: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products 3/	3,380	$18,500	$5.47
Asphaltic concrete aggregates and other bituminous mixtures	110	392	3.56
Road base and coverings 4/	511	4,010	7.85
Fill	225	418	1.86
Other miscellaneous uses 5/	48	533	11.10
Unspecified: 6/			
Actual	3,510	25,200	7.19
Estimated	1,920	12,400	6.43
Total or average	9,700	61,400	6.33

1/ To avoid disclosing company proprietary data, no district tables were produced for 1996.
2/ Data are rounded to three significant digits except value per ton; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Includes road and other stabilization (cement and lime).
5/ Includes filtration, railroad ballast, and snow and ice control.
6 Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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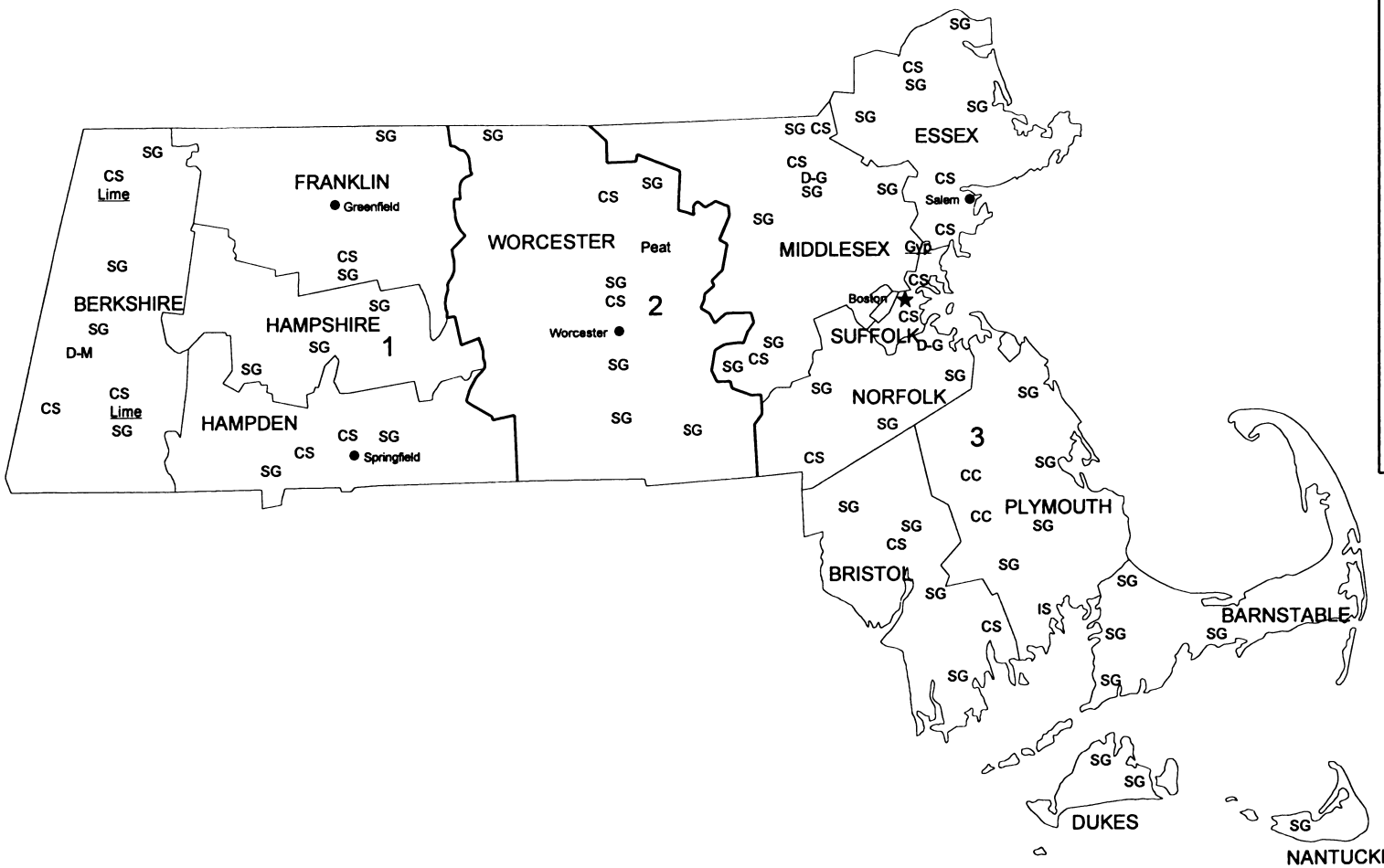
MASSACHUSETTS



LEGEND

- State boundary
- County boundary
- Capital
- City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS

CC	Common clay
CS	Crushed stone
D-G	Dimension granite
D-M	Dimension marble
Gyp	Gypsum plant
IS	Industrial sand
Lime	Lime plant
Peat	Peat
SG	Sand and gravel

0 20 Kilometers

Source: Massachusetts Executive Office of Environmental Affairs/U.S. Geological Survey

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THE MINERAL INDUSTRY OF MASSACHUSETTS

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Massachusetts Executive Office of Environmental Affairs for collecting information on all nonfuel minerals.

In 1997, for the third consecutive year, Massachusetts ranked 39th in the Nation in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $213 million, about a 7% increase from that of 1996. This followed a 5.2% increase from 1995 to 1996 (based on final 1996 data). The State accounted for about 0.5% of the U.S. total nonfuel mineral production value.

The leading mineral commodities by value in Massachusetts were construction sand and gravel and crushed stone, respectively. Dimension stone was third. In 1997, a 9% or about an $8 million increase in the value of construction sand and gravel, plus a 6% or $5 million increase in crushed stone accounted for most of the State's rise in nonfuel mineral production value. Only peat showed a small decrease for the year. In 1996, an increase in construction sand and gravel value led to the State's overall increase in value, moderated somewhat by a decrease in the value of crushed stone. Based on USGS estimates of the quantities produced in the United States during 1997, Massachusetts remained sixth in the production of dimension stone.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities, such as construction sand and gravel and crushed stone, estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MASSACHUSETTS 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays, common	31	W	W	W	W	W
Gemstones	NA	W	NA	1	NA	1
Sand and gravel, construction	11,700	67,500	14,200	82,500	15,200	90,100
Stone:						
Crushed	11,100	97,400	11,800 3/	91,600 3/	12,500 3/	97,000 3/
Dimension metric tons	77,600	14,600	79,600	15,000	80,000	15,100
Combined value of lime, peat, sand and gravel [industrial (1996-97)], stone [crushed miscellaneous (1996-97)], and values indicated by symbol W	XX	10,700	XX	11,100	XX	11,300
Total	XX	190,000	XX	200,000	XX	213,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined value" data.

TABLE 2
MASSACHUSETTS: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	4	2,020	$21,800	$10.80	6 2/	2,140 2/	$23,500 2/	$10.97 2/
Limestone-dolomite	1	W	W	8.04	--	--	--	--
Dolomite	1	W	W	1.08	--	--	--	--
Granite	9 r/	3,210 r/	29,400 r/	9.15	9	3,200	24,600	7.71
Traprock	17 r/	5,670 r/	44,500 r/	7.84 r/	19	6,450	43,500	6.74
Miscellaneous stone	2	W	W	9.20	(3/)	(3/)	(3/)	(3/)
Total	XX	11,100	97,400	8.76	XX	11,800 3/	91,600 3/	7.77

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits except unit value; may not add to totals shown.
2/ Includes "Limestone-dolomite" reported with no distinction between the two.
3/ Excludes miscellaneous stone from State total to avoid disclosing company proprietary data.

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TABLE 3
MASSACHUSETTS: CRUSHED STONE SOLD OR USED
BY PRODUCERS IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	37	$316	$8.54
Riprap and jetty stone	53	450	8.49
Filter stone	68	519	7.63
Other coarse aggregate	175	1,180	6.72
Coarse aggregate, graded:			
Concrete aggregate, coarse	317	2,240	7.05
Bituminous aggregate, coarse	4,630	30,600	6.61
Railroad ballast	353	2,270	6.42
Other graded coarse aggregate 3/	813	7,810	9.61
Fine aggregate (-3/8 inch):			
Screening, undesignated	419	2,010	4.79
Other fine aggregate 4/	633	4,300	6.79
Coarse and fine aggregates:			
Graded road base or subbase	354	2,130	6.01
Crusher run or fill or waste	434	3,450	7.95
Other construction materials 5/	182	2,140	11.77
Agricultural:			
Agricultural limestone	W	W	14.00
Poultry grit and mineral food	W	W	14.00
Chemical and metallurgical, lime manufacture	W	W	6.75
Special, other fillers or extenders	W	W	58.04
Unspecified: 6/			
Actual	W	W	9.11
Estimated	2,730	23,200	8.49
Total	11,800	91,600	7.77

W/ Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, granite, limestone, limestone-dolomite, and traprock.
2/ Data are rounded to three significant digits except unit value; may not add to totals shown.
3/ Includes bituminous surface-treatment aggregate.
4/ Includes stone sand (bituminous mix or seal) and stone sand (concrete).
5/ Includes building products and roofing granules.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
MASSACHUSETTS: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	W	W	148	1,120	W	W
Coarse aggregate, graded 3/	W	W	912	5,990	W	W
Fine aggregate (-3/8 inch) 4/	W	W	49	191	W	W
Coarse and fine aggregate 5/	W	W	265	1,280	W	W
Other construction materials 6/	1,520	10,900	--	--	5,580	40,000
Agricultural 7/	(8/)	(8/)	--	--	--	--
Chemical and metallurgical 9/	(8/)	(8/)	--	--	--	--
Special 10/	(8/)	(8/)	(8/)	(8/)	--	--
Unspecified: 11/						
Actual	–	–	–	–	(8/)	(8/)
Estimated	1,580	13,800	(8/)	(8/)	(8/)	(8/)
Total	3,600	33,000	1,880	12,900	6,310	45,800

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Includes graded road base or subbase and crusher run (select material or fill).
6/ Includes building products and roofing granules.
7/ Includes agricultural limestone, and poultry grit and mineral food.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes lime manufacture.
10/ Includes other fillers or extenders.
11/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
MASSACHUSETTS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	2,930	$18,300	$6.25
Plaster and gunite sands	46	467	10.15
Concrete products (blocks, bricks, pipe, decorative, etc.)	66	476	7.21
Asphaltic concrete aggregates and other bituminous mixtures	792	4,040	5.11
Road base and coverings 2/	1,300	6,410	4.93
Fill	1,620	6,770	4.19
Snow and ice control	377	1,880	4.98
Railroad ballast	63	229	3.63
Other miscellaneous uses 3/	1,050	9,290	8.82
Unspecified: 4/			
Actual	1,270	3,510	2.76
Estimated	4,730	31,100	6.58
Total or average	14,200	82,500	5.79

1/ Data are rounded to three significant digits except value per ton; may not add to totals shown.
2/ Includes road and other stabilization (lime).
3/ Includes filtration.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
MASSACHUSETTS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	579	4,310	1,070	6,780	1,390	8,160
Asphaltic concrete aggregates and road base materials 3/	811	4,750	1,510	6,790	1,390	5,680
Snow and ice control	62		114	342	201	1,140
Railroad ballast	--	--	63	229	--	--
Other miscellaneous uses 4/	64	286	470	2,880	519	6,130
Unspecified: 5/						
Actual	--	--	899	1,490	373	2,020
Estimated	730	3,120	405	2,340	3,590	25,600
Total	2,250	12,900	4,530	20,800	7,470	48,800

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill and road and other stabilization (lime).
4/ Includes filtration.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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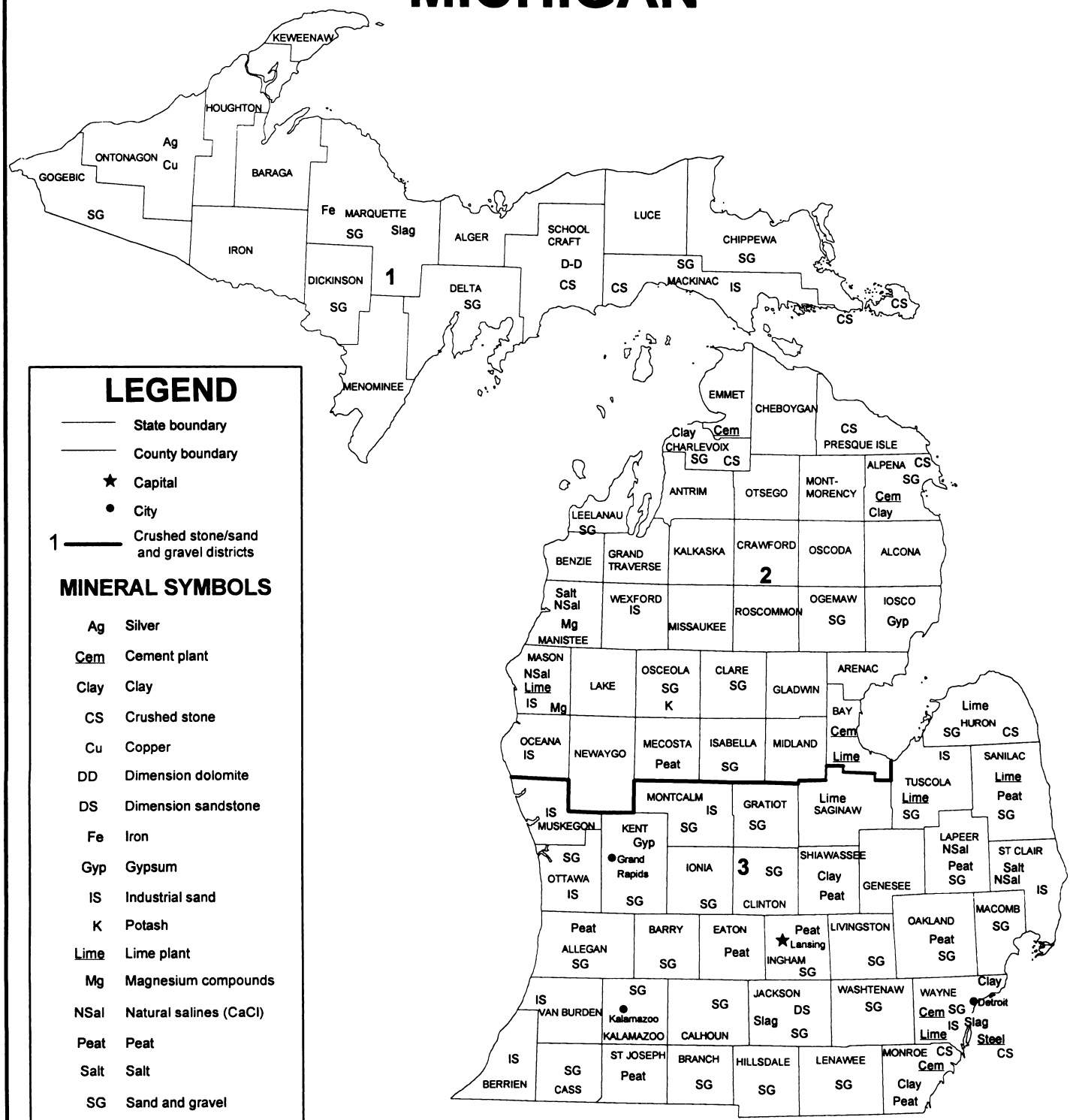
MICHIGAN



LEGEND

- State boundary
- County boundary
- ★ Capital
- ● City
- 1 —— Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Ag	Silver
Cem	Cement plant
Clay	Clay
CS	Crushed stone
Cu	Copper
DD	Dimension dolomite
DS	Dimension sandstone
Fe	Iron
Gyp	Gypsum
IS	Industrial sand
K	Potash
Lime	Lime plant
Mg	Magnesium compounds
NSal	Natural salines (CaCl)
Peat	Peat
Salt	Salt
SG	Sand and gravel
Slag	Slag
Steel	Iron and steel plant

0 100 Kilometers

Source: Geological Survey Division, Michigan Department of Natural Resources/U.S. Geological Survey

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THE MINERAL INDUSTRY OF MICHIGAN

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Geological Survey Division, Michigan Department of Natural Resources, for collecting information on all nonfuel minerals.

In 1997, for the third consecutive year, Michigan ranked ninth in the Nation in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $1.56 billion, about a 1% increase from that of 1996. This followed a 1.3% increase from 1995 to 1996 (based on final 1996 data). The State accounted for nearly 4% of the U.S. total nonfuel mineral production value.

Michigan continued to be the Nation's second leading iron ore-producing State in 1997, although portland cement moved ahead of iron ore as the State's leading nonfuel mineral, based on value. Construction sand and gravel was third and magnesium compounds was fourth. In 1997, the combined increase in the values of construction sand and gravel, portland cement, and crushed stone more than compensated for significant decreases in the values of iron ore and salt, resulting in the State's net gain for the year. (All listings are presented in descending order of magnitude of increase or decrease.) Also supporting the rise in value were increases in magnesium compounds, common clays, potash, bromine, and masonry cement. Other mineral commodities that decreased in value included gypsum, industrial sand and gravel, and peat. In 1996, the most significant decrease in value resulted from the cessation of copper (and silver) mine production in the State. But the decrease in copper together with a significant decrease in salt and smaller drops in the values of lime, bromine, and industrial sand and gravel were more than balanced out by the increased values of iron ore, portland cement, magnesium compounds, construction sand and gravel, crushed stone, and masonry cement.

Compared with USGS estimates of the quantities produced in the other 49 States in 1997, Michigan remained first in magnesium compounds and iron oxide pigments; second in iron ore, industrial sand and gravel, bromine, and peat; fourth in portland cement and crude gypsum; and sixth in masonry cement. The State rose to second from third in construction sand and gravel, to third from fourth in potash, and was a significant producer of crushed stone, lime, and common clays. Michigan remained fifth in the Nation in the manufacture of raw steel with an estimated output of more than 6.6 million metric tons, as reported by the American Iron and Steel Institute.

The following narrative information was provided by the Michigan Department of Natural Resources (MDNR), Real Estate Division[2] (RED). Early in 1997, Cleveland Cliffs Iron Co. (CCI) applied to the Michigan Department of Environmental Quality (MDEQ) for permission to place mine waste rock in Tilden Lake. This would allow for continued operation and growth of the Tilden Mine. In late September, MDEQ issued a permit allowing the filling of the 22-hectare lake, 610 meters of unnamed creeks, and 7 hectares of wetlands. A required 10.3 hectares of wetland mitigation along with additional mitigation work must still to be performed.

Production quotas for the Tilden Mine resulted in a planned 6-week shutdown in mid-1997. However, electric power shortages in the Midwest caused the shutdown to go into effect earlier, and also created a slowdown of production at the nearby Empire Mine.

The U.S. Environmental Protection Agency (EPA) reviewed solution mining plans for the White Pine Mine, but, by late May, Inmet Mining Corp., owner of the Copper Range Co. and its White Pine Mine, withdrew their plans and announced they would close and flood the mine, and begin site cleanup of the area. New industries are being sought for the area to help replace the hundreds of jobs lost. One proposal included using part of the top of the mine to grow flowers and vegetables underground. Various uses were proposed for surface buildings.

BHP Copper Co. announced plans to buy Inmet's White Pine Copper Refinery in early 1998. White Pine had been processing imported anodes following closure of the White Pines Smelter and Mine in 1995. The refinery has a capacity of 68,000 tons of copper per year.

The EPA continued to oppose mining sphagnum peat from the Minden Bog in Sanilac County by Michigan Peat Co. The EPA will require the company to obtain a wetland's permit from the U.S. Army Corps of Engineers before mining may continue at the present location or expand. In early June, MDEQ announced that they would no longer oppose the peat mining operation on the 385-hectare bog.

Four mining exploration firms drilled a total of 18 drill holes, totaling about 5,500 meters of exploratory drilling in search of metallic mineral deposits in 1997. The exploration efforts for base and precious metals included lands of both private and public ownership.

At yearend, 70 State metallic mineral leases covering about

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information and for the, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Milton Gere, Geologist, authored the text of mineral industry information provided by the MDNR's Real Estate Division.

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7,300 hectares of State-owned fee and mineral ownership lands were in effect. Seventeen direct State metallic leases were applied for in 1996 and issued in 1997. They are located in Houghton and Ontonagon Counties. An additional 130 hectares were applied for, but later withdrawn by the applicant. Presently there are no operating metallic mineral mines located on State-owned lands.

Three applicants requested to lease State mineral lands under the Nonmetallic Mineral Leasing program to mine salt in Wayne County, and limestone/dolomite in Luce and Mackinac Counties. The Mackinac County location was denied during the field review stage. The other two sites are continuing into the review stages in early 1998. Presently there are two State Nonmetallic Mineral Leases in effect. Plans to provide a Direct Lease version continues to be reviewed. Two existing Nonmetallic Mineral Leases and related items cover 119 hectares of State-owned land.

The Statewide Geological Core and Sample Repository continued to add materials to its collection at Marquette. Drill core, cuttings, and hand samples from 67 of Michigan's 83 counties collected from mineral exploration, oil and gas well, and water well activities make up this vast collection. The repository also houses the old metallic mine map and data collection. This "rock library" facility is run by the Geological Survey Division of DEQ and is open for public use by appointment.

Geological records and information derived from lapsed State Metallic Mineral Leases are collected and maintained for future reference. This inventory is kept by the RED's Minerals Lease Management Section, Lansing, MI, and is available to the public for review.

The Statewide Abandoned Underground Mine Inventory Project is expected to continue until completed. All idled and truly abandoned underground mine sites, excluding the previously inventoried coal mines, are included. This will aid public safety and future planning in areas previously mined. Reviews of available mine maps have indicated about 750 or more mines with nearly 2,000 openings to the surface exist on public and private lands. Field investigation will help determine safety remediation needs. The inventory is funded by the State through the RED. The inventory work is contracted to the Department of Mining Engineering, Michigan Technical University, at Houghton, Michigan.

Public Act 149 of 1997 created a Revised Mine Reclamation Act covering open pit metallic mines. The Act and enforcement are funded by a production fee paid by the mining operators. The MDEQ's Geological Survey Division enforces this Act.

Public Act 154 of 1997 reduced the mineral rights title period for certain severed mineral rights including metallic minerals to 20 years. It is an Act intended to assist in reuniting severed mineral and surface interests to a common fee ownership.

Quincy Mine Hoist Association, Hancock, MI, started operating their new tramway between the historic old Quincy No. 2 Copper Mine hoist and the mine adit for their tourist mine tour. At one time, the Quincy was the deepest mine in North America, exceeding 2,800 meters depth on the incline.

Besides a rich mineral history, Michigan has bountiful untapped metallic and nonmetallic mineral and fuel resources. Presently, production at Michigan's several limestone, dolomite, other stone and gypsum quarries and mines continues. Also, the sand, gravel, industrial sand, and related producers are busy, as are the producers of lime, cement, and various salt products.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MICHIGAN 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement:						
Masonry	229	16,700	232	20,400 e/	237	21,200 e/
Portland	5,400	361,000	5,390	397,000 e/	5,500	413,000 e/
Clays, common	623	3,430	652	3,410	698	8,330
Gemstones	NA	2	NA	1	NA	1
Gypsum, crude	1,510	14,900	1,590	14,400	1,540	11,000
Iron ore, usable	13,500	W	W	W	W	W
Lime	653	34,600	584	30,300	590	30,700
Peat	173	5,510	168	4,650	167	4,090
Sand and gravel:						
Construction	53,500	178,000	53,800	197,000	59,300	222,000
Industrial	2,940	30,600	2,680	29,400	2,720	27,700
Stone, crushed	37,500	127,000	38,600 3/	144,000 3/	41,000 3/	160,000 3/
Combined values of bromine, copper (1995), iron oxide pigments (crude), magnesium compounds, potash, salt, silver (1995), stone [crushed granite and miscellaneous (1996-97), dimension dolomite and sandstone], and values indicated by symbol W	XX	750,000	XX	695,000	XX	664,000
Total	XX	1,520,000	XX	1,540,000	XX	1,560,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined value" data.

TABLE 2
MICHIGAN: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	21	29,200	$97,500	$3.35	22	30,300	$115,000	$3.78
Dolomite	6	8,110	28,700	3.54	6	8,330	29,100	3.50
Granite	--	--	--	--	(2/)	(2/)	(2/)	(2/)
Traprock	1	13	26	2.00	--	--	--	--
Calcareous marl	2	W	W	4.08	1	7	20	2.86
Sandstone	2	W	W	13.20	1	7	120	17.14
Marble	1	W	W	3.00	--	--	--	--
Shell	1	W	W	6.68	--	--	--	--
Miscellaneous stone	1	W	W	1.40	(2/)	(2/)	(2/)	(2/)
Total	XX	37,500	127,000	3.38	XX	38,600	144,000	3.72

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Excludes granite and miscellaneous stone from State total to avoid disclosing company proprietary data.

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TABLE 3
MICHIGAN: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	92	$998	$10.85
Filter stone	85	374	4.40
Other coarse aggregate	23	106	4.61
Coarse aggregate, graded:			
Concrete aggregate, coarse	1,910	6,100	3.20
Bituminous aggregate, coarse	584	2,550	4.37
Bituminous surface-treatment aggregate	393	1,880	4.77
Railroad ballast	103	524	5.09
Other graded coarse aggregate	W	W	6.70
Fine aggregate (-3/8 inch):			
Stone sand, bituminous mix or seal	341	1,260	3.70
Screening, undesignated	413	1,370	3.31
Other fine aggregate	1	1	1.00
Coarse and fine aggregates:			
Graded road base or subbase	1,510	5,660	3.75
Unpaved road surfacing	1,270	5,660	4.46
Crusher run or fill or waste	25	72	2.88
Other coarse and fine aggregates	10	36	3.60
Other construction materials 3/	221	1,470	6.66
Agricultural:			
Agricultural limestone	111	779	7.02
Poultry grit and mineral food	(4/)	(4/)	2.86
Chemical and metallurgical:			
Cement manufacture	4,430	20,800	4.68
Lime manufacture	(4/)	(4/)	2.44
Flux stone	4,190	16,700	3.99
Other miscellaneous uses, sugar refining	229	978	4.27
Unspecified: 5/			
Actual	21,700	73,500	3.39
Estimated	436	1,630	3.75
Total	38,600	144,000	3.72

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Includes calcareous marl, dolomite, limestone, and sandstone; excludes granite and miscellaneous stone from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes drain fields.
4/ Withheld to avoid disclosing company proprietary data; included in "Total."
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
MICHIGAN: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	W	W	W	W	W	W
Coarse aggregate, graded 3/	W	W	1,860	5,850	W	W
Fine aggregate (-3/8 inch) 4/	W	W	W	W	252	595
Coarse and fine aggregate 5/	W	W	1,080	3,830	W	W
Other construction materials 6/	1,060	3,350	594	2,450	--	--
Agricultural 7/	(8/)	(8/)	(8/)	(8/)	(8/)	(8/)
Chemical and metallurgical 9/	(8/)	(8/)	(8/)	(8/)	(8/)	(8/)
Other miscellaneous use 10/	--	--	229	978	--	--
Unspecified: 11/						
Actual	7,150	18,700	9,690	35,600	4,840	22,200
Estimated	--	--	--	--	436	1,630
Total	9,760	26,000	19,900	77,600	8,950	40,100

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, and railroad ballast.
4/ Includes stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Includes graded road base or subbase, unpaved road surfacing, and crusher run (select material or fill).
6/ Includes drain fields.
7/ Includes agricultural limestone and other agricultural uses.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes cement manufacture, flux stone, and lime manufacture.
10/ Includes sugar refining.
11/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
MICHIGAN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	8,120	$32,800	$4.04
Plaster and gunite sands	72	296	4.11
Concrete products (blocks, bricks, pipe, decorative, etc.)	724	3,290	4.54
Asphaltic concrete aggregates and other bituminous mixtures	4,970	20,200	4.07
Road base and coverings 2/	8,360	24,000	2.87
Fill	3,630	9,400	2.59
Snow and ice control	522	1,810	3.46
Filtration	86	467	5.43
Other miscellaneous uses 3/	1,220	15,200	12.47
Unspecified: 4/			
Actual	15,100	50,300	3.32
Estimated	11,000	39,000	3.55
Total or average	53,800	197,000	3.66

1/ Data are rounded to three significant digits, except value per ton; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes railroad ballast.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
MICHIGAN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	322	2,290	759	3,070	7,830	31,000
Asphaltic concrete aggregates and road base materials 3/	515	1,600	2,210	5,970	10,600 4/	36,600 4/
Fill	314	506	521	669	2,800	8,230
Snow and ice control	79	229	167	419	275 4/	1,160 4/
Other miscellaneous uses 5/	20	136	216	1,310	1,070	14,200
Unspecified: 6/						
Actual	69	255	741	2,560	14,300	47,500
Estimated	1,860	5,680	1,700	5,820	7,410	27,500
Total	3,180	10,700	6,320	19,800	44,300 4/	166,000 4/

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement and lime).
4/ Includes production within the State with no district reported.
5/ Includes railroad ballast.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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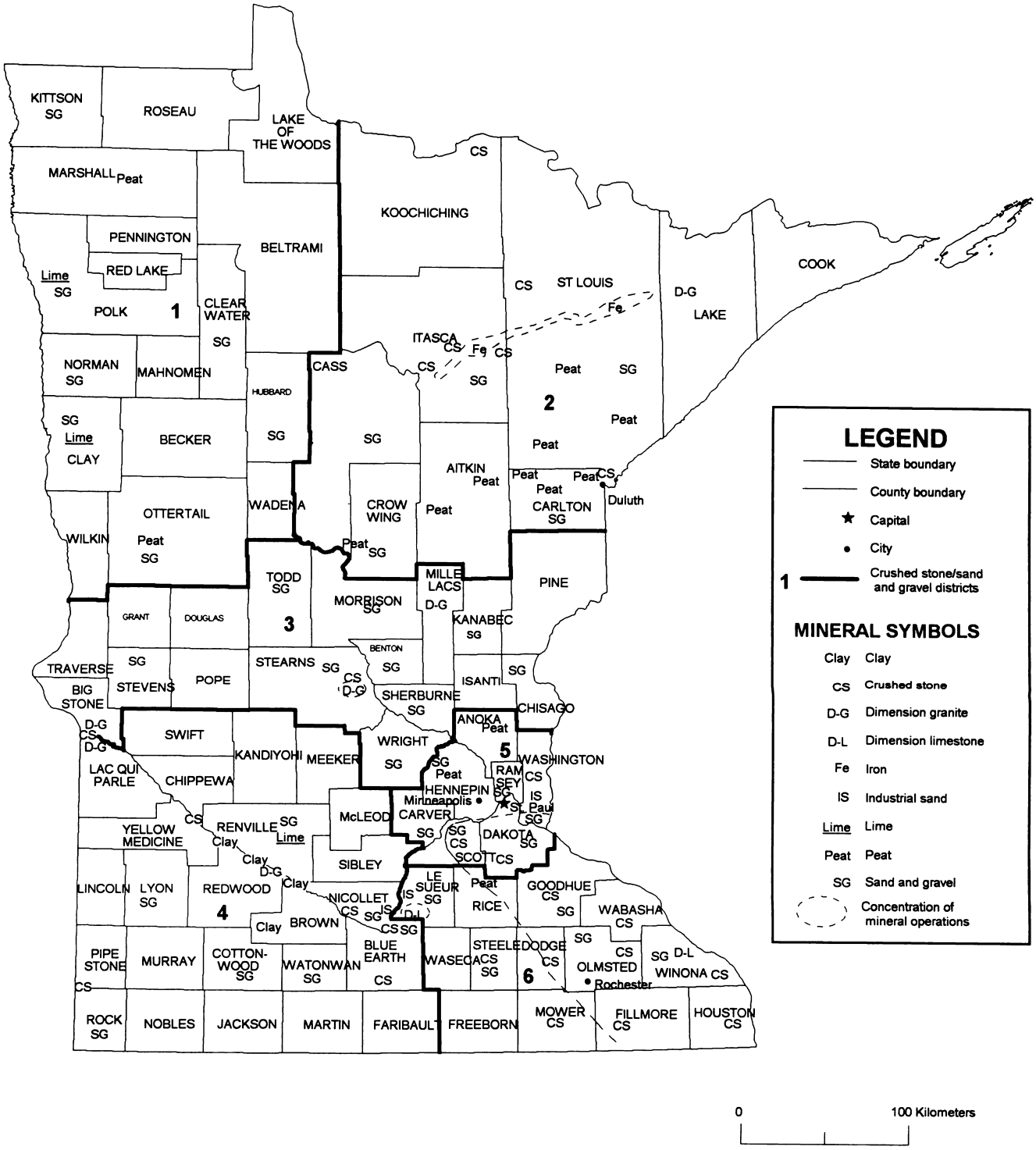
MINNESOTA



Source: Minnesota Department of Natural Resources, Minerals Division/U.S. Geological Survey

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THE MINERAL INDUSTRY OF MINNESOTA

Minnesota remained eighth among the 50 States in total nonfuel mineral production value[1] in 1997, according to the U.S. Geological Survey (USGS). The estimated total nonfuel mineral value for the State in 1997 was almost $1.6 billion, a 4% increase from that of 1996. This followed a marginal increase from 1995 to 1996 (based on final 1996 data). The State accounted for 4% of the U.S. total nonfuel mineral production value.

In 1997, iron ore accounted for more than 83% of the State's nonfuel mineral production value, while construction sand and gravel and crushed stone accounted for about 10% and 4%, respectively. In 1997, whereas nearly all nonfuel minerals increased in value, the 50% or $54 million increase in the value of construction sand and gravel accounted for most of the State's rise in nonfuel mineral production value (table 1).

Compared to USGS estimates of quantities produced in the other 49 States in 1997, Minnesota remained 1st in the Nation in iron ore and 10th in industrial sand. The State rose from sixth to fourth in the production of peat and from ninth to fifth in construction sand and gravel. Additionally, the State produced significant quantities of crushed stone and dimension stone.

The following narrative information was provided by the Minnesota Department of Natural Resources' Minerals Division (MDNRMD).[2] The State of Minnesota issued 14 nonferrous metallic mineral leases in 1997. Twelve leases, covering 2,175 hectares, were issued through public lease sale and cover lands in Aitkin, Beltrami, Crow Wing, and Lake of the Woods Counties. The first lease was issued through the new preference rights leasing system, under which State lands are continually available for leasing after having first been offered through public sale. A negotiated lease was issued to Lehmann Exploration Management, Inc. for a portion of the bed of Birch Lake on the border of Lake and St. Louis Counties. Exploration has been conducted for platinum-group metals in this terrane, which is part of the base of the Middle Proterozoic mafic layered Duluth Complex.

Exmin, Cominco Ltd., and the American Shield Co. drilled a total of eight exploratory holes in Aitkin, Beltrami, Koochiching, Marshall, and St. Louis Counties. These companies are exploring for diamond, and for base and precious metals. MDNRMD drilled five bedrock holes in Aitkin and St. Louis Counties. Core from these holes was used to evaluate a dimension stone prospect and a granite prospect, and to evaluate mineral potential of the Early Proterozoic greenstones in Central Minnesota and the western contact of the Duluth Complex.

A multi-agency committee was formed to encourage new mineral exploration in Minnesota. The committee released a new brochure titled "Take a New Look at Minnesota Minerals!". The committee also compiled information for a *Mining Journal* supplement due out in early 1998. In addition, the Iron Range Resources and Rehabilitation Board offered its Drilling Incentive Grant Program, which matches up to 40% of direct drilling costs, but not to exceed a match of $20,000.

A heavy minerals study of glaciofluvial sediments was completed in cooperation with the USGS covering different bedrock geological terranes. Three potential mineral-resource areas have been identified for eventual follow-up.

A preliminary geologic map of the Allen Quadrangle, which straddles the Middle Proterozoic Duluth Complex basal contact along with accompanying gravity and aeromagnetic data, illustrates the geology, structure, and related copper, nickel, and iron-titanium mineralization within the area. This was a collaboration between staff at the Natural Resources Research Institute and the Minnesota Geological Survey.

Studies are in progress by the University of Minnesota Duluth (UMD) to assess the gold and volcanogenic massive sulfide potential of selected greenstone terranes of the northeastern portion of the State. A geographical information systems approach has been taken for evaluating these types of mineralization in the State. This methodology has led to the preliminary recognition of three areas with potential mineralization.

State agencies, mineral industry, and academia have embarked on a cooperative effort to improve access to archived mineral exploration data. The cornerstone for this improved access is the object-based exploration and product model that guides users through and across State mineral leasing, drill core, exploration, and applied research files.

The iron mining industry in Minnesota remained strong with seven taconite plants producing more than 46 million metric tons of iron concentrates in pellet form. US Steel Group USX (Minntac) expanded its domestic iron ore production at its 7.2-kilometer-long west pit. Permits were granted and operations commenced in the fall of 1997 after completion of an environmental assessment worksheet and negotiated agreements, lease transfers, and new leases between Minntac, Ontario Iron Co., and the State of Minnesota.

The Iron Ore Cooperative Research Committee—made up of representatives from producers, research labs, and State governments—selected process and concentrator modeling as its two highest priority items. A computational fluid dynamic

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Maryanna Harstad, Senior Planner, authored the text of State mineral industry information provided by the MDNRMD.

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modeling (CFD) center was established at University of Minnesota. The center will be a cooperative venture between the Coleraine Minerals Research Laboratory and the Department of Chemical Engineering at UMD. A concentrator modeling center will also be established. A committee is meeting to develop the business plan and select a site for the concentrator modeling center.

The CFD center's efforts are expected to focus on improving pelletizing operations at the State's taconite plants. An employee from the Department of Chemical Engineering has written a one-dimensional model that estimates heat and mass transfer, pellet drying and oxidation, and nitric oxide emissions on Grate-kiln pelletizing machines. The model has been calibrated on several pelletizing lines using existing data and the results have justified the expenditure for additional mass flow instrumentation on one of the lines at Minntac.

The 1997 Minnesota Legislature created two new financial incentives for the mining industry. Grant funding of $3.5 million was appropriated for the development of a direct reduction iron processing facility in Minnesota. A technology grant program was also created for the taconite industry for research work that would reduce energy consumption, reduce environmental emissions, improve productivity, or improve pellet quality. The initial grant funding of $650,000 was awarded to National Steel Pellet Co. for modification to its pelletizing line.

Legislation was passed to clarify the ownership of stockpiled metallic minerals material surrounding many of the former mining sites in the State. Tax forfeitures of real estate containing stockpiles were creating ownership issues that affected local landuse management decisionmaking. The legislation was introduced after study and discussion by representatives of State and local government, fee and stockpile owners, and mining industry representatives.

Research on the use of several biosolids as a soil amendment for revegetation of coarse tailings was initiated at EVTAC Mining Co. and National Steel Pellet Co. Biosolids being evaluated include dredge spoils, paper manufacturing wastes, sewage sludge, and composted municipal solid waste.

According to USGS preliminary estimates (*table 1*), about 59 million tons of aggregate valued at $221 million was produced in 1997. Aggregate consumption continues to rise in Minnesota. Consumption falls into four general categories: roads; public works projects; residential construction; and commercial/industrial applications. According to the Minnesota Department of Transportation (MDOT), total government investment in the State's transportation infrastructure will be approximately $2.2 billion for the 3-year period 1997-99. The Department of Natural Resources (DNR) works with MDOT and local governments to identify new potential areas of aggregate resources to meet future road construction project needs.

In June 1997, the Clay County Beach Ridges Forum concluded a 2-year discussion by landowners, aggregate producers, supporters of native prairie, interested public, and government agencies about gravel mining and prairie protection. The forum developed computerized resource information o n CD-ROM, a coloring book for children showing the value of prairie and gravel resources, a handbook of one-page fact sheets, maps, and a final report containing recommendations.

Minnesota is making a number of efforts to educate K-12 teachers about exploration and mining-related issues. A collaborative effort by industry, government, and academia led to the first annual Minnesota Minerals Education Workshop in August 1997. The 3-day workshop included speakers, hands-on classroom activities, resource materials, and field trips to geological formations and mining operations.

To improve and expand communication with Mesabi Range land management groups, the DNR developed Geographic Information System maps which illustrated existing minerals information in a user-friendly format. Efforts began in 1997 to present this information to communities to aid in the initial steps of land use planning. Communities, governments, and the mining industry can use customized pertinent data to utilize existing minerals resources and to plan for future land use after mining is completed.

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TABLE 1
MINNESOTA: NONFUEL RAW MINERAL PRODUCTION 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Common	27	W	11	W	W	W
Kaolin	21	W	--	--	--	--
Gemstones	NA	26	NA	148	NA	677
Iron ore, usable	47,000	1,330,000	46,700	1,330,000	46,900	1,330,000
Peat	24	2,070	20	1,540	37	2,610
Sand and gravel, construction	31,900	99,400	31,800	107,000	46,800	161,000
Stone:						
Crushed	11,300 3/	47,400 3/	12,100	59,000	12,000	60,000
Dimension metric tons	26,900	11,100	25,400	10,700	25,600	10,800
Combined value of lime, sand and gravel (industrial), stone [crushed quartzite and traprock (1995)], and values indicated by symbol W	XX	40,400	XX	35,100	XX	34,900
Total	XX	1,530,000	XX	1,540,000	XX	1,600,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined value" data.

TABLE 2
MINNESOTA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 2/				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	29 r/	7,490 r/	$32,400 r/	$4.33	43	8,210	$38,800	$4.73
Granite	6 r/	W	W	4.63	4	W	W	W
Dolomite	5	W	2,420	W	3	802	3,480	4.34
Sandstone and quartzite	6 r/	W	W	4.27	6	944	W	W
Traprock	--	--	--	--	1	W	W	4.39
Total	XX	11,300	47,400	4.19	XX	12,100	59,000	4.88

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excludes quartzite and traprock from State total to avoid disclosing company proprietary data.

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TABLE 3
MINNESOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996,
BY USE 1/ 2/ 3/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	231	$1,690	$7.33
Filter stone	191	1,150	6.02
Coarse aggregate, graded:			
Concrete aggregate, coarse	849	5,770	6.79
Bituminous aggregate, coarse	312	1,740	5.58
Railroad ballast	839	5,550	6.62
Other graded coarse aggregate 4/	68	600	8.82
Fine aggregate (-3/8 inch)			
Stone sand, concrete	53	280	5.28
Stone sand, bituminous mix or seal	99	338	3.41
Other fine aggregate 5/	226	1,120	4.95
Coarse and fine aggregates:			
Graded road base or subbase	2,500	11,400	4.55
Unpaved road surfacing	530	1,820	3.43
Terrazzo and exposed aggregate	W	W	9.74
Crusher run or fill or waste	W	W	2.28
Other coarse and fine aggregates	W	W	4.75
Other construction materials	280	1,720	6.16
Agricultural:			
Agricultural limestone	199	1,070	5.39
Poultry grit and mineral food	(6/)	(6/)	15.57
Chemical and metallurgical, lime manufacture	(6/)	(6/)	7.25
Unspecified: 7/			
Actual	2,440	10,700	4.38
Estimated	3,270	14,000	4.28
Total	12,100	59,000	4.88

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ To avoid disclosing company proprietary data; district tables were not produced for 1996.
2/ Includes dolomite, granite, limestone, sandstone, quartzite, and traprock.
3/ Data are rounded to three significant digits except unit value; may not add to totals shown.
4/ Includes bituminous surface-treatment aggregate.
5/ Includes screening (undesignated).
6/ Withheld to avoid disclosing company proprietary data; included in "Total."
7/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
MINNESOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	7,680	$35,400	$4.61
Plaster and gunite sands	89	710	7.98
Concrete products (blocks, bricks, pipe, decorative, etc.)	221	1,780	8.05
Asphaltic concrete aggregates and other bituminous mixtures	2,850	11,700	4.12
Road base and coverings 2/	9,410	21,800	2.32
Fill	2,220	3,920	1.77
Snow and ice control	238	816	3.43
Railroad ballast	299	709	2.37
Other miscellaneous uses 3/	281	888	3.16
Unspecified: 4/			
Actual	2,050	9,760	4.75
Estimated	6,510	19,600	3.00
Total or average	31,800	107,000	3.36

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes filtration and roofing granules.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
MINNESOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	440	2,600	359	1,900	1,640	6,020
Asphaltic concrete aggregates and road base materials 3/	1,860	4,050	880	2,040	5,900	12,400
Snow and ice control	26	85	55	130	86	222
Other miscellaneous uses 4/	174	437	282	682	44	229
Unspecified: 5/						
Actual	438	2,260	322	762	179	2,900
Estimated	1,810	5,120	754	2,300	880	2,530
Total	4,740	14,600	2,650	7,820	8,730	24,300
	District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	627	3,150	4,500	21,900	425	2,250
Asphaltic concrete aggregates and road base materials 3/	1,950	7,150	2,500	8,700	1,390	3,150
Snow and ice control	19	58	26	234	26	86
Other miscellaneous uses 4/	22	114	19	43	38	93
Unspecified: 5/						
Actual	344	1,100	542	2,070	228	661
Estimated	1,200	3,870	1,190	3,240	677	2,500
Total	4,160	15,400	8,770	36,200	2,780	8,750

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill and road and other stabilization (cement and lime).
4/ Includes filtration, railroad ballast and roofing granules.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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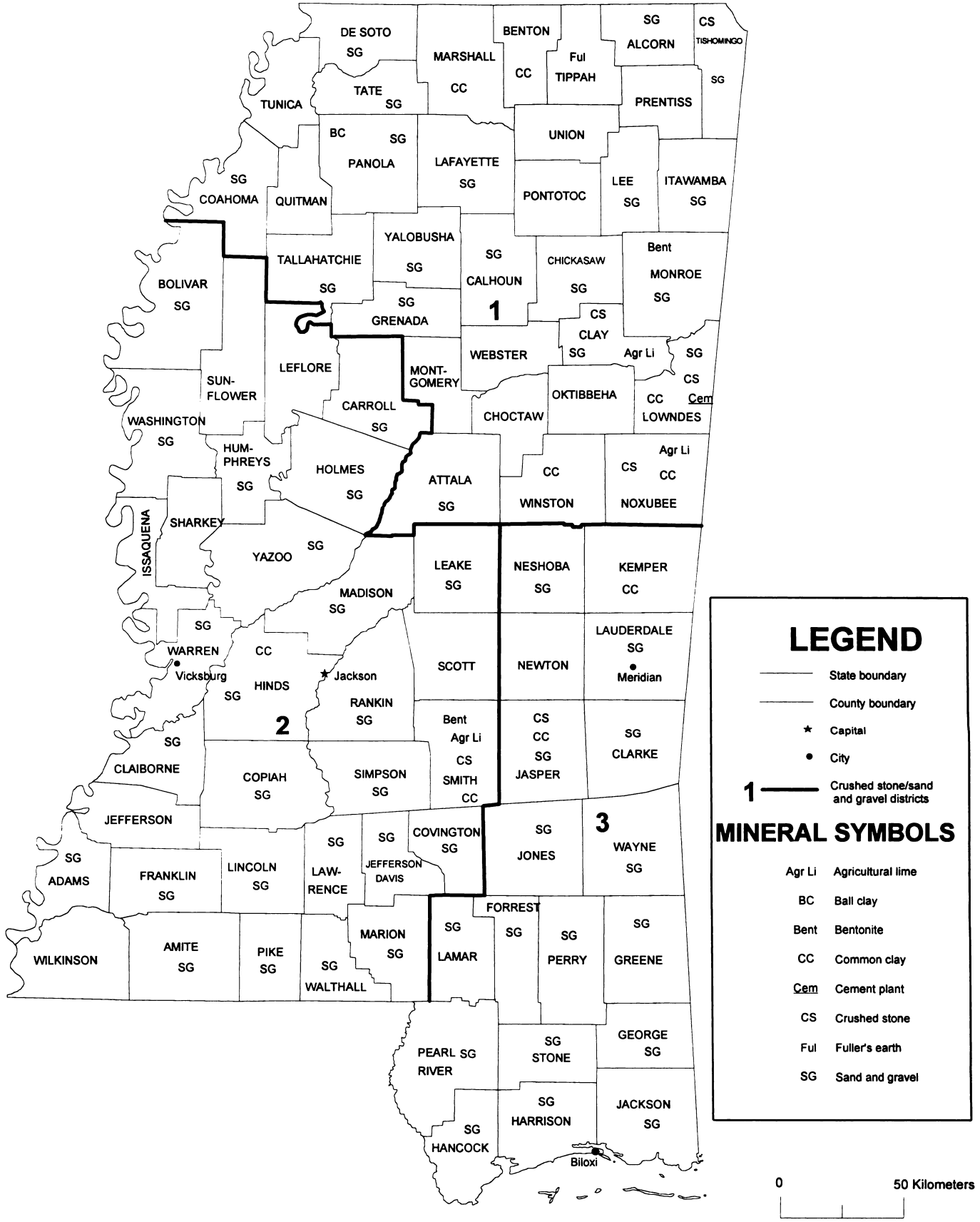
MISSISSIPPI



Source: Mississippi Office of Geology, Department of Environmental Quality/U.S. Geological Survey

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THE MINERAL INDUSTRY OF MISSISSIPPI

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Mississippi Office of Geology, Department of Environmental Quality, for collecting information on all nonfuel minerals.

In 1997, for the fourth consecutive year, Mississippi ranked 42d among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $137 million, a 5% decrease from that of 1996. This followed a nearly 10% increase from 1995 to 1996 (based on final 1996 data). The State accounted for a little less than 0.5% of the U.S. total nonfuel mineral production value in 1997.

Construction sand and gravel was Mississippi's leading nonfuel mineral, accounting for 41% of the State's value in 1997. Portland cement and fuller's earth followed respectively as the State's second- and third-leading commodities. Most of the State's drop in value in 1997 resulted from the decreases in construction sand and gravel and fuller's earth (*table 1*). In 1996, most of the year's rise in value resulted from the increases in portland cement and construction sand and gravel.

Based on USGS estimates of the quantities of raw minerals produced in the 50 States during 1997, Mississippi remained one of the top five producers of bentonite, and dropped from second to third in fuller's earth and third to fourth in ball clay. Additionally, significant quantities of common clays were produced in the State. Metals produced in Mississippi, especially raw steel, were processed from materials received from other domestic and foreign sources.

The following narrative information was provided by the Mississippi Department of Environmental Quality's Office of Geology[2] (OG); the agency reported mining activity during 1997 for sand, gravel, industrial and brick-grade clays (including some of the highest-grade calcium bentonite in the world), as well as some quarrying for limestone and dolomite.

The OG's Mining and Reclamation Division (MRD), charged with enforcement of the Mississippi Surface Mining and Reclamation Act of 1977 (SMRA), regulates Mississippi's mining activities. The mining industry is one of the State's most important industries, contributing thousands of jobs and tens of millions of dollars to the Mississippi economy. The MRD currently has jurisdiction over nearly 6,900 hectares being mined in the State; this land area includes, in addition to the nonfuel minerals listed in table 1, the extraction of such materials as topsoil and other soils, borrow, and fill materials.

The OG and its divisions compile data based on its fiscal year (July 1 to June 30). In fiscal year 1997, MRD approved 63 new mining permits and performed more than 1,450 inspections of existing mines. Mining operations using 1.6 hectares of land or less do not need a mining permit but have to submit a notice of exemption to MRD. One hundred and twenty-four notices of exempt operations were received in 1997. Active mining permits on file at the end of fiscal year 1997 totaled 777, while the total exemptions were 755.

The MRD reviewed a permit application for Mississippi's first low-grade coal (lignite) mine. The mine, located in Choctaw County, will be strip mined while continuous reclamation is performed. The final permit may apply to as much as 6,500 hectares. As projected by the permittee and the associated power company, an estimated output of 400 megawatts of electricity will be generated by lignite supplied from the mine for use in providing power to a number of counties in the eastern part of the State.

The MRD continued to place emphasis on getting mined land reclaimed and put back into useful and productive purposes. In accordance with the SMRA, mine operators must post a performance bond that is released only upon satisfactory reclamation of the land affected by mining activities. In fiscal year 1997, more than 445 bond release hectares were reclaimed. More bond hectares were reclaimed and more final bond releases were granted in fiscal year 1997 than in any previous year.

The OG continued the Mine Safety and Health Administration (MSHA) training for miners. This training is for operations that process mined material, such as rock crushing and gravel washing facilities, and is vitally important to the mining industry in Mississippi. The OG expects fatalities in the State to remain at low levels in large part because of this training. The OG hosted the Southeastern Regional Conference of MSHA trainers in March on the Gulf Coast in Biloxi.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]James Starnes, a Geologist with the Mississippi Department of Environmental Quality's Office of Geology, provided the Mississippi mineral industry information.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MISSISSIPPI 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Ball	73	4,540	73	4,540	73	4,540
Bentonite	164	6,510	145	4,480	156	4,630
Common	616	6,080	534	3,610	566	3,730
Fuller's earth	378	26,900	379	27,800	332	25,200
Gemstones	NA	1	NA	1	NA	1
Sand and gravel, construction	11,800	53,000	13,400	60,600	12,100	56,300
Stone, crushed 3/	1,990	8,010	2,180	9,300	1,900	8,300
Combined value of cement (portland), sand and gravel (industrial), stone (crushed marl)	XX	25,500	XX	33,500	XX	34,800
Total	XX	131,000	XX	144,000	XX	137,000

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined value" data.

TABLE 2
MISSISSIPPI: CRUSHED STONE SOLD OR USED, BY KIND 1/ 2/

Kind	1995 3/				1996 3/			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	4	1,990	$8,010	$4.03	4	2,180	$9,300	$4.26

1/ To avoid disclosing company proprietary data; district and use tables were not produced for 1996.
2/ Data are rounded to three significant digits.
3/ Excludes calcareous marl from State total to avoid disclosing company proprietary data.

TABLE 3
MISSISSIPPI: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	3,770	$18,300	$4.84
Plaster and gunite sands	50	248	4.96
Concrete products (blocks, bricks, pipe, decorative, etc.)	108	451	4.18
Asphaltic concrete aggregates and other bituminous mixtures	1,830	9,150	5.00
Road base and coverings 2/	1,430	5,610	3.93
Unspecified: 3/			
Actual	3,480	15,600	4.49
Estimated	2,690	11,300	4.20
Total or average	13,400	60,600	4.54

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes fill, road and other stabilization (cement and lime), and snow and ice control.
3/ Includes production reported with a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
MISSISSIPPI: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	2,250	10,800	1,080	5,330	602 3/	2,790 3/
Asphaltic concrete aggregates and road base materials 4/	1,600	7,630	1,170	5,360	491 3/	1,770 3/
Unspecified: 5/						
Actual	1,720	7,190	1,540	7,750	218	672
Estimated	179	707	2,110	9,010	406	1,610
Total	5,740	26,400	5,900	27,400	1,720 3/	6,840 3/

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes production within the State with no district reported.
4/ Includes fill and road and other stabilization (cement and lime), and snow and ice control.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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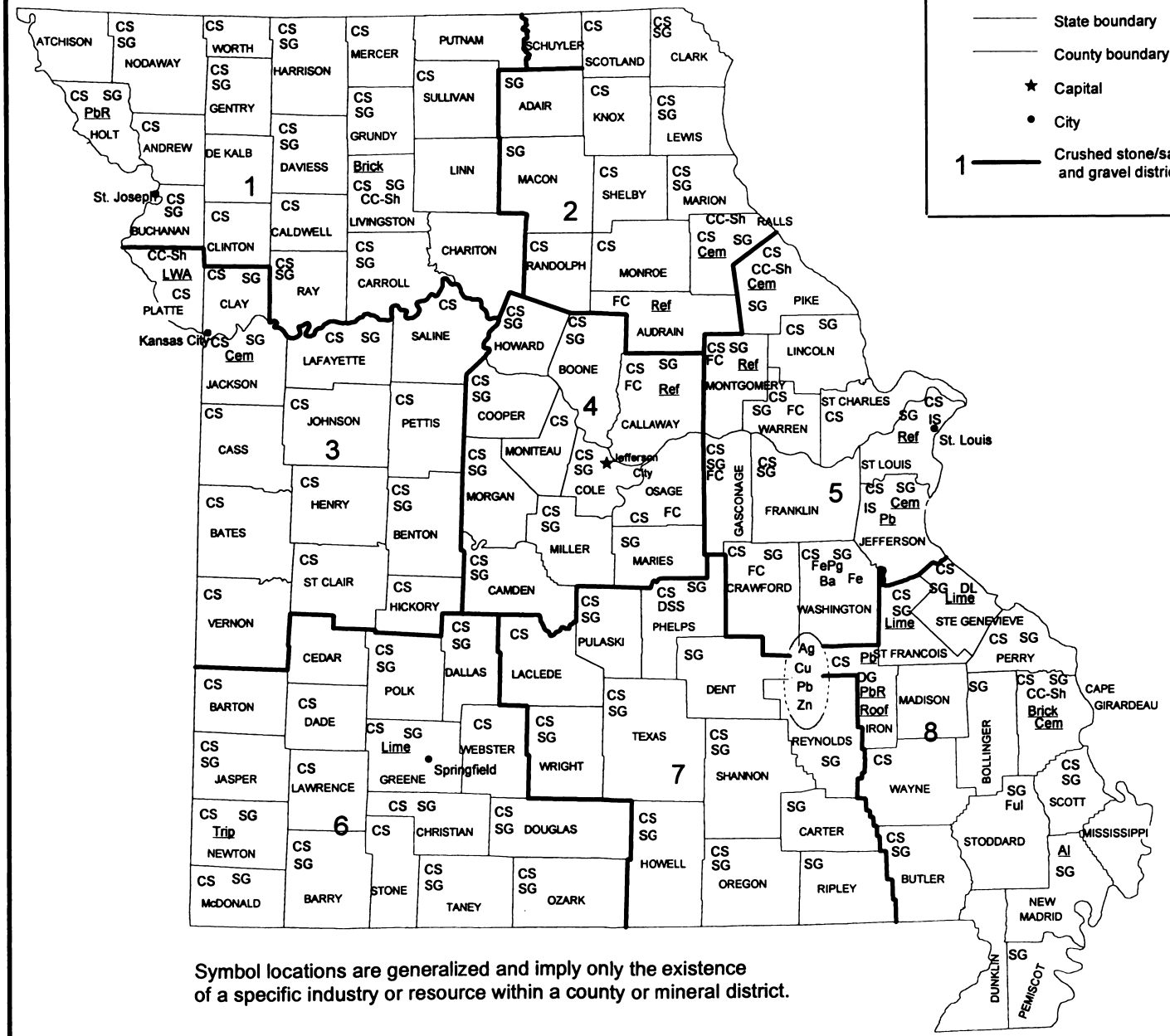
MISSOURI



LEGEND

- State boundary
- County boundary
- ★ Capital
- • City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Ag	Silver
Al	Aluminum plant
Ba	Barite
Brick	Brick plant
CC-Sh	Common clay and shale
Cem	Cement plant
CS	Crushed stone
Cu	Copper
DG	Dimension granite
DL	Dimension limestone
DSS	Dimension sandstone
FC	Fire clay
Fe	Iron
FePg	Iron oxide pigments
Ful	Fuller's earth
IS	Industrial sand
Lime	Lime plant
LWA	Lightweight aggregate plant
Pb	Lead
Pb	Lead smelter
PbR	Lead recycling facility
Ref	Refractory clay products plant
Roof	Roofing granule plant
SG	Sand and gravel
Trip	Tripoli plant
Zn	Zinc
⬭	Concentration of mineral operations

0 50 Kilometers

Symbol locations are generalized and imply only the existence of a specific industry or resource within a county or mineral district.

Source: Missouri Department of Natural Resources, Division of Geology and Land Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF MISSOURI

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and Missouri Department of Natural Resources, Division of Geology and Land Survey for collecting information on all nonfuel minerals.

In 1997, for the fourth consecutive year, Missouri ranked 10th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $1.32 billion, about a 6% increase from that of 1996. This followed a 9.6% increase from 1995 to 1996 (based on final 1996 data). The State accounted for more than 3% of the U.S. total nonfuel mineral production value.

Missouri is, by a large measure, the top lead-producing State in the Nation. The State produced more than three times the quantity of lead as that of the next highest producing State in 1997. Crushed stone replaced lead as the State's leading nonfuel mineral commodity by value. Except for several years in the mid-1980's and 1993-95, lead has been Missouri's leading nonfuel mineral since 1969. Crushed stone surpassed lead and portland cement in 1993 and ranked first through 1995.

In 1997, crushed stone, lead, portland cement, and lime combined accounted for 84% of the State's total nonfuel mineral production value. Significantly increased values for crushed stone and zinc, together with a more moderate increase for portland cement accounted for most of the State's increase in 1997 (*table 1*). Conversely, only lead showed a comparatively significant drop in value of more than $10 million. All other changes in 1997 were relatively small. In 1996, the State's increase in value mainly resulted from a substantial increase in the value of lead with large but more moderate increases in portland cement, crushed stone, and lime.

Compared with USGS estimates of quantities produced in the other 49 States in 1997, Missouri remained first in lime and fire clays; second in iron oxide pigments; third in iron ore; third of four barite-producing States; fourth in zinc; fifth in portland cement and fuller's earth; and seventh in silver. The State rose from 4th to 3d in the production of crushed stone and 11th to 10th in common clays. Additionally, the State was a significant producer of industrial sand and gravel and masonry cement.

The following narrative information was provided by the Missouri Department of Natural Resources, Division of Geology and Land Survey[2]. The crushed stone industry continued at near record production levels in 1997. Commercial and private construction sales were especially strong in urban areas. Markets in rural areas, especially in northwest and northeast Missouri, were slow because of reduced demand for State work. Agricultural lime sales were also slow. Concern was expressed by the aggregate and construction industries regarding funding problems for the Missouri Department of Transportation's 15-year highway program.

Environmental and other problems facing the industrial minerals industry increased during the year. Air quality regulations, increasingly strict specifications for some aggregate products, and problems with permitting new or expanded sites were mentioned by many operators.

Consolidation occurred in the crushed stone industry as small operations were purchased by national and multinational companies. Lafarge Aggregates acquired two quarries from Howard Quarries, one quarry from Menefee Quarries, and two operations from Missouri Portable Stone, Inc. Weber Quarries acquired Iron Mountain Traprock and opened three additional sites. APAC acquired Limpus Quarries and purchased several aggregate and construction companies in central and southwest Missouri. Pace Construction acquired McClain Quarries at Danville and Capitol Quarries bought Curtman Materials at Owensville in central Missouri. Capitol Sand acquired the Lafarge Aggregates sand and gravel plant at Arlington in southcentral Missouri.

Construction sand and gravel operators reported a good-to-average year. Residential construction and readymix markets continued strong, although weakness developed in some sand markets for State work. Aggregate dredging operations complicated navigation for commercial barge operators on the Missouri River. Negotiations continue between the States, various environmental and commercial interests, along with the U.S. Corps of Engineers regarding future management practices for the river. These planned future management practices appear to include high water levels in the spring to simulate natural flooding conditions, but may interfere with and cause increased costs for river operators.

Calendar year 1997 was good for the clay industry because of low interest rates. Demand was very good for residential brick and the outlook for 1998 is promising. Construction continued through much of the winter because of mild weather. Low fuel costs were important both at the kiln and in the transportation of

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Ardel Rueff, Geologist, authored the text of State mineral industry information submitted by the Division of Geology and Land Survey.

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the finished product.

The industrial sand, lime, and cement industries all had a good year during 1997. Little change is expected for the industrial sand industry in 1998. Foundry and glass bottling markets were strong. A major problem facing the industry is the proposed increased controls on the emissions of particulate matter.

Lime sales were strong, particularly in environmental markets. Some problems were reported in transportation, both with rail "bottlenecks" and competition from grain shippers for dual use cars. Vessel Mineral Products Co. bought Resco Mineral Products of Missouri's lime and stone operations at Bonne Terre, but closed the lime plant. Mississippi Lime Co. started construction of a Maerz vertical shaft kiln at its Ste. Genevieve plant.

Several cement producers reportedly ran out of product at times during the year. The industry expects some "flattening" of demand in the next several years. Modernization and expansion plans continued at Holnam Inc. in Pike County and Lafarge Cement in Jackson County.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MISSOURI 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement, portland	4,360	270,000	4,530	293,000 e/	4,620	305,000 e/
Clays						
Ball	--	--	13	W	W	W
Common	972	4,810	849	3,250	984	3,370
Fire	359	5,480	223	3,220	217	3,150
Fuller's earth	283	W	283	W	283	W
Copper 3/	7	22,800	W	W	W	W
Gemstones	NA	58	NA	108	NA	650
Sand and gravel, construction	8,840	32,400	9,820	35,600	9,760	36,200
Stone, crushed	65,700 4/	305,000 4/	67,000	325,000	71,000	360,000
Combined value of barite, cement (masonry), iron ore (usable), iron oxide pigments (crude), lead, lime, sand and gravel (industrial), silver, stone [crushed granite (1995), dimension granite], zinc, and values indicated by symbol W	XX	495,000	XX	589,000	XX	610,000
Total	XX	1,140,000	XX	1,250,000	XX	1,320,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Recoverable content of ores, etc.

4/ Excludes certain stones; kind and value included with "Combined value" data.

TABLE 2
MISSOURI: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone 2/	189 r/	62,500 r/	$290,000 r/	$4.64	194	63,300	$305,000	$4.82
Dolomite	21 r/	3,070 r/	15,200 r/	4.94 r/	24	2,590	13,000	5.02
Granite	(3/)	(3/)	(3/)	(3/)	2	W	W	7.31
Sandstone	1	200	442	2.21	1	W	W	2.26
Traprock	--	--	--	--	1	W	W	4.36
Total	XX	65,700	305,000	4.64	XX	67,000	325,000	4.85

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes "limestone-dolomite," reported with no distinction between the two.

3/ Excludes granite from State total to avoid disclosing company proprietary data.

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TABLE 3
MISSOURI: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	188	$1,250	$6.66
Riprap and jetty stone	2,700	8,900	3.29
Filter stone	164	851	5.19
Other coarse aggregate	555	2,990	5.38
Coarse aggregate, graded:			
Concrete aggregate, coarse	3,140	18,300	5.82
Bituminous aggregate, coarse	1,730	10,000	5.82
Bituminous surface-treatment aggregate	1,120	5,860	5.25
Other graded coarse aggregate 3/	3,960	30,800	7.79
Fine aggregate (-3/8 inch):			
Stone sand, concrete	292	1,770	6.08
Stone sand, bituminous mix or seal	87	983	11.30
Screening, undesignated	1,070	3,730	3.49
Other fine aggregate	132	256	1.94
Coarse and fine aggregates:			
Graded road base or subbase	8,740	34,900	3.99
Unpaved road surfacing	2,350	10,600	4.53
Crusher run or fill or waste	245	939	3.83
Other coarse and fine aggregates	647	3,030	4.69
Other construction materials 4/	507	4,860	9.59
Agricultural limestone 5/	1,250	5,970	4.76
Chemical and metallurgical:			
Cement manufacture	8,670	28,300	3.26
Lime manufacture	1,160	4,780	4.13
Dead-burned dolomite manufacture	W	W	7.59
Flux stone	W	W	7.41
Chemical stone	W	W	4.29
Special, asphalt fillers or extenders	7	36	5.14
Unspecified: 6/			
Actual	11,600	61,300	5.28
Estimated	16,500	83,700	5.06
Total	67,000	325,000	4.85

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, granite, limestone, limestone-dolomite, sandstone, and traprock.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes railroad ballast.
4/ Includes roofing granules, terrazzo and exposed aggregate, and waste material.
5/ Includes poultry grit and mineral food.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
MISSOURI: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 2/	W	W	W	W	W	W	W	W
Coarse aggregate, graded 3/	147	889	W	W	1,540	18,000	620	3,080
Fine aggregate (-3/8 inch) 4/	W	W	W	W	W	W	W	W
Coarse and fine aggregate 5/	300	1,520	269	1,260	1,060	4,770	712	3,380
Other construction materials 6/	105	561	176	902	337	2,350	295	1,040
Agricultural 7/	33	149	(8/)	(8/)	(8/)	(8/)	77	297
Chemical and metallurgical 9/	--	--	(8/)	(8/)	(8/)	(8/)	--	--
Special 10/	--	--	--	--	--	--	--	--
Unspecified: 11/								
Actual	1,180	8,770	--	--	3,210	17,500	--	--
Estimated	2,400	12,100	3,570	20,100	1,590	8,020	2,460	11,700
Total	4,170	24,000	4,970	25,600	8,590	56,100	4,160	19,500

	District 5		District 6		District 7		District 8	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 2/	619	3,130	W	W	W	W	W	W
Coarse aggregate, graded 3/	3,790	22,100	1,990	12,600	W	W	1,320	5,950
Fine aggregate (-3/8 inch) 4/	1,040	3,610	W	W	--	--	W	W
Coarse and fine aggregate 5/	4,310	18,200	1,740	8,680	187	808	3,800	15,300
Other construction materials 6/	--	--	468	2,950	496	2,190	2,280	6,780
Agricultural 7/	(8/)	(8/)	(8/)	(8/)	(8/)	(8/)	(8/)	(8/)
Chemical and metallurgical 9/	(8/)	(8/)	(8/)	(8/)	--	--	(8/)	(8/)
Special 10/	--	--	--	--	--	--	7	36
Unspecified: 11/								
Actual	5,640	27,600	1,200	5,710	(8/)	(8/)	(8/)	(8/)
Estimated	2,000	9,550	1,770	9,120	671	3,260	2,060	9,790
Total	22,400	96,800	8,530	46,000	1,420	6,530	12,800	50,600

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Inlcudes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, andother graded coarse aggregate.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Includes crusher run (select material or fill), graded road base or subbase, other coarse and fine aggregates, terrazzo and exposedaggregate, and unpaved road surfacing.
6/ Includes roofing granules and waste material.
7/ Includes agricultural limestone and poultry grit and mineral food.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes cement manufacture, chemical stone for alkali works, dead-burned dolomite, flux stone, and lime manufacture.
10/ Includes asphalt fillers or extenders.
11/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 5
MISSOURI: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	3,790	$15,700	$4.13
Plaster and gunite sands	71	338	4.76
Concrete products (blocks, bricks, pipe, decorative, etc.)	233	1,350	5.78
Asphaltic concrete aggregates and other bituminous mixtures	276	1,180	4.29
Road base and coverings 2/	200	832	4.16
Fill	109	404	3.71
Snow and ice control	88	346	3.93
Other miscellaneous uses 3/	1,160	2,740	2.36
Unspecified: 4/			
Actual	875	1,590	1.82
Estimated	3,020	11,200	3.70
Total or average	9,820	35,600	3.62

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes filtration and roofing granules.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 6
MISSOURI: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 5	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	36	194	W	W	W	W
Asphaltic concrete aggregates and road base materials 4/	34	133	W	W	W	W
Other miscellaneous uses 5/	--	--	140	586	4,720	17,400
Unspecified: 6/						
Actual	--	--	--	--	754	1,250
Estimated	340	1,280	1,150	3,690	984	4,620
Total	410	1,610	1,290	4,280	6,460	23,300
	District 6		District 7		District 8	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	46	343	199	735	542	2,390
Asphaltic concrete aggregates and road base materials 4/	15	88	61	219	108	516
Other miscellaneous uses 5/	27	229	--	--	(7/)	1
Unspecified: 6/						
Actual	--	--	--	--	121	344
Estimated	10	39	153	438	377	1,090
Total	98	701	413	1,390	1,150	4,340

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
1/ Production reported in District 3 was included with "District 2" and production reported in District 4 was included with "District 5" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Includes fill, road and other stabilization (cement), and snow and ice control.
5/ Includes filtration and roofing granules.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.
7/ Less than 1/2 unit.

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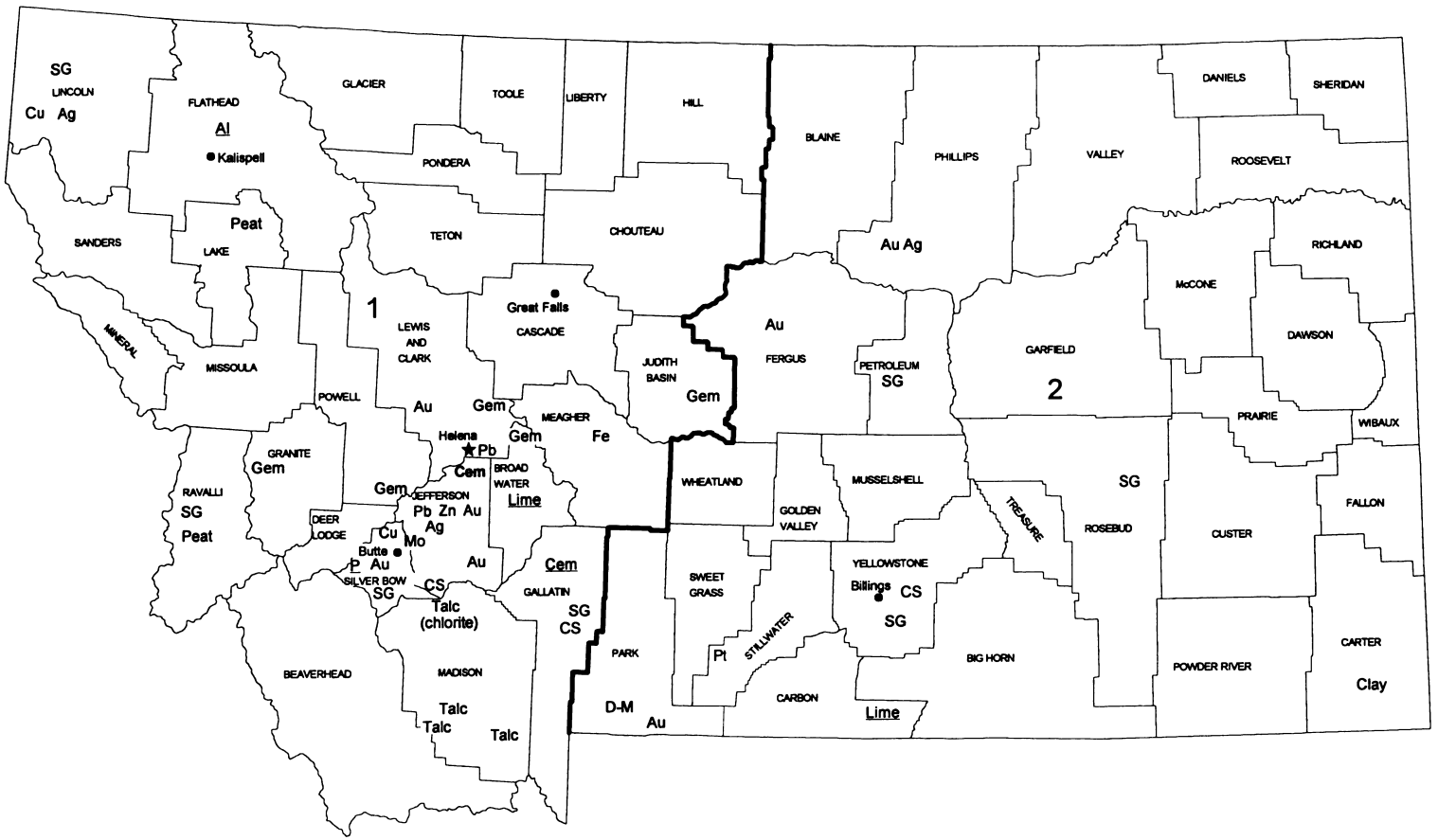
MONTANA



LEGEND

- State boundary
- County boundary
- ★ Capital
- • City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Ag	Silver
Al	Aluminum plant
Au	Gold
Cem	Cement plant
Clay	Clay
Cu	Copper
D-M	Dimension marble
Fe	Iron
Gem	Gemstones
Lime	Lime plant
Mo	Molybdenum
P	Phosphate rock plant
Peat	Peat
Pb	Lead smelter
Pt	Platinum-group metals
SG	Stone and gravel
Talc	Talc minerals
Zn	Zinc

0 — 100 Kilometers

Source: Montana Bureau of Mines and Geology/U.S. Geological Survey

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THE MINERAL INDUSTRY OF MONTANA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and Montana Bureau of Mines and Geology for collecting information on all nonfuel minerals.

Montana remained 28th in the Nation in nonfuel mineral production value[1] in 1997, according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $498 million, a 1% increase from that of 1996. This followed a 14.5% decrease from 1995 to 1996 (based on final 1996 data). The State accounted for more than 1% of the U.S. total nonfuel mineral production value.

Overall, metallic minerals accounted for 73% of the State's total nonfuel mineral value. By value, copper was Montana's leading nonfuel mineral, followed by gold. Portland cement was the State's third-leading nonfuel mineral commodity.

In 1997, large increases in the values of palladium, zinc, and platinum (*table 1*), plus smaller increases in portland cement and molybdenum, more than compensated for decreases in gold, copper, and silver. This resulted in a net gain in nonfuel mineral production value for the year. (All listings are in descending order of the magnitude of change.) Other values that increased in 1997 were industrial garnet, construction sand and gravel, and lime. Other values that decreased included those of industrial sand and gravel, gemstones, talc and pyrophyllite, and lead. All other mineral commodity values remained virtually the same.

In 1996, significant decreases of similar magnitude for both copper and gold, plus smaller decreases for bentonite and zinc accounted for most of the year's decrease in value. Relative to these changes, small increases occurred in 1996 in the values of lead, palladium, platinum, portland cement, molybdenum, construction sand and gravel, and talc.

Based on USGS estimates of the quantities produced in the 50 States in 1997, Montana continued as the only U.S. producer of primary platinum and palladium. The State remained first in the production of talc and pyrophyllite; third of three industrial garnet-producing States; fourth in lead; fifth in molybdenum and zinc; and sixth in gold and silver. Montana continued as one of the top five bentonite-producing States, but it dropped to fifth from fourth in the production of copper.

The following narrative information was provided by the Montana Bureau of Mines and Geology[2] (MBMG). Mining in Montana had a year of conflicting perspectives. For the most part, industrial mineral companies had a good year with growth, high prices, and increasing markets. Base metal prices were steady to lower, creating an atmosphere of further 'belt tightening' and resourcefulness. The gold industry took several direct impacts beginning with the Bre-X Minerals Ltd. scandal in Indonesia, which severely limited the availability of venture capital, followed by Australia's announcement that it had sold the majority of its gold reserves. The year ended with gold prices nearly $100 per ounce less than in preceding years. This reduction created significant stress among producers whose annual reports indicated production costs at or above the selling price. Price hedging in advanced sales at higher prices will delay critical decisions for many gold producers. However, few companies are in a position to survive long periods of operating at a loss.

Mineral exploration reached a new low as the last of the major companies closed its Montana offices. Many corporate geologists had no stateside office to retreat to and found themselves employed in foreign countries, if employed at all. Exploration funds disappeared this year and it even seemed difficult for companies to generate funding for late-stage programs, at least partially because of the Bre-X scandal. Individual prospectors maintained very low levels of activity because the cost of holding claims remained high and the availability of prospective buyers was low.

A longstanding court case, Sierra Club Legal Defense Fund vs. Department of Agriculture (Forest Service), regarding Noranda Minerals Corp.'s Montanore project, challenged the validity of the initial prewilderness claims. The court sided with the Forest Service, verifying Noranda's existing rights and strengthening the company's position for patenting the property.

Beal Mountain Mining, a wholly owned subsidiary of Pegasus Gold, Inc., completed mining operations at its Beal Mountain Mine. Production from the South Beal ore body was completed in early October. The company expected to continue leaching the pads and then to rinse the remaining cyanide from the heaps before commencing final pad reclamation in 3 to 4 years. East of Lincoln, Phelps Dodge Corp. sold its interest in the McDonald Gold project to its joint venture partner, Canyon Resources Corp. Permitting of the project has been extremely slow. Although the draft Environmental Impact Statement was started a year ago, a product is not expected in the near future.

West of Townsend, Montana Tunnels Mining Inc. maintained

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Robin B. McCulloch, Staff Mining Engineer, authored the text of mineral industry information submitted by the Montana Bureau of Mines and Geology.

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grade control and reserves. To date, four ore zones have been identified.

West of Jefferson City, Montana Tunnels' mining activity has produced ore at its lead-zinc-gold diatreme. Production was interrupted by pit-wall instability in midsummer when a slide on the north wall temporarily stopped production. The company had sufficient stockpiled ore from its Diamond Hill Mine to maintain mill production while mine production was stopped.

West of Malta, Zortman Mining Co.'s plans for an expansion of its Zortman gold and silver operation were again put on hold. An appeal to the consent decree was filed by the Island Mountain Protectors and the National Wildlife Federation, and by the Assinniboine, Gros Ventre, Fort Belknap Indian Council. This placed the decision for the Zortman expansion back into the courts for an expected 2 to 3 years.

Near Nye, the Stillwater Mining Co. has nearly completed the production-upgrade project started a couple of years ago for platinum-group metals. According to the company, the shaft has been completed and has achieved a production rate of 1,800 metric tons per day ore throughput, although the company is still plagued with a severe shortage of skilled miners and mine mechanics. The mill upgrade is complete, as is the base metal refinery. The smelter capacity is being expanded from 22 to 29 tons of concentrate per day.

Prices for platinum and palladium are up and have remained steady. In November, the Board of Directors authorized the remainder of funds for completion of a tunnel boring machine for the East Boulder project. Delivery is expected in May and the long access drift is expected to be completed in approximately 18 months.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MONTANA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995		1996		1997 p/	
		Quantity	Value	Quantity	Value	Quantity	Value
Clays, common		33	90	34	W	34	W
Gemstones		NA	938	NA	1,840	NA	872
Gold 3/	kilograms	12,400	155,000	9,110	114,000	7,900	86,300
Iron ore, usable		5	60	–	–	W	W
Lead 3/	metric tons	8,350	7,790	7,970	8,580	8,000	8,320
Palladium	kilograms	5,260	22,000	6,100	25,500	8,340	46,700
Platinum	do.	1,590	20,800	1,840	23,500	2,500	31,700
Sand and gravel, construction		8,870	34,900	9,260	35,800	9,200	36,500
Silver 3/	metric tons	77	12,700	W	W	W	W
Stone, crushed		2,370 4/	9,920 4/	2,000	8,580	1,900	8,600
Zinc 3/	metric tons	22,700	27,900	19,400	21,900	22,300	39,800
Combined value of cement, clays (bentonite, fire), copper, garnet [industrial (1996-97),] lime, molybdenum, peat, sand and gravel (industrial), stone [crushed quartzite (1995), dimension miscellaneous], talc and pyrophyllite, and values indicated by symbol W		XX	283,000	XX	251,000	XX	239,000
Total		XX	574,000	XX	491,000	XX	498,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Recoverable content of ores, etc.
4/ Excludes certain stones; kind and value included with "Combined value" data.

TABLE 2
MONTANA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	11	1,960	$8,300	$4.23	13	1,540	$6,240	$4.06
Traprock	4	289	1,150	3.98	3	W	W	8.30
Sandstone and quartzite	3 2/	112 2/	457 2/	4.08 2/	3	W	W	3.56
Volcanic cinder and scoria	1	6	16	2.67	1	3	9	3.00
Total	XX	2,370	9,920	4.19	XX	2,000	8,580	4.29

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excludes quartzite from State total to avoid disclosing company propietary data.

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TABLE 3
MONTANA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/ 3/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse and fine aggregates, other construction materials 4/	443	$2,800	$6.32
Chemical and metallurgical, cement manufacture	(5/)	(5/)	3.97
Special, mine dusting or acid water treatment	(5/)	(5/)	3.31
Unspecified: 6/			
Actual	3	9	3.00
Estimated	613	2,030	3.30
Total	2,000	8,580	4.29

1/ To avoid disclosing company proprietary data, no district tables were produced for 1996.
2/ Includes limestone, quartzite, sandstone, traprock and volcanic cinder and scoria.
3/ Data are rounded to three significant digits; may not add to totals shown.
4/ Includes crusher run or fill or waste, other coarse aggregate, railroad ballast, riprap and jetty stone, stone sand (concrete), and unpaved road surfacing.
5/ Withheld to avoid disclosing company proprietary data; included in "Total."
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 4
MONTANA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	959	$4,840	$5.05
Plaster and gunite sands	2	5	2.50
Asphaltic concrete aggregates and other bituminous mixtures	1,270	5,770	4.55
Road base and coverings 2/	4,150	15,600	3.75
Fill	347	739	2.13
Other miscellaneous uses 3/	458	1,820	3.98
Unspecified: 4/			
Actual	222	720	3.24
Estimated	1,850	6,350	3.42
Total or average	9,260	35,800	3.87

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes filtration, railroad ballast, and snow and ice control.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
MONTANA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregates (including concrete sand) 2/	694	3,410	268	1,430
Asphaltic-bituminous mixtures	656	2,820	613	2,950
Road base and coverings 3/	1,770	6,150	2,380	9,410
Fill	306	664	40	75
Other miscellaneous uses 4/	387	1,420	70	403
Unspecified: 5/				
Actual	204	656	18	63
Estimated	1,350	4,630	500	1,720
Total	5,370	19,700	3,890	16,000

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement).
4/ Includes filtration, railroad ballast, and snow and ice control.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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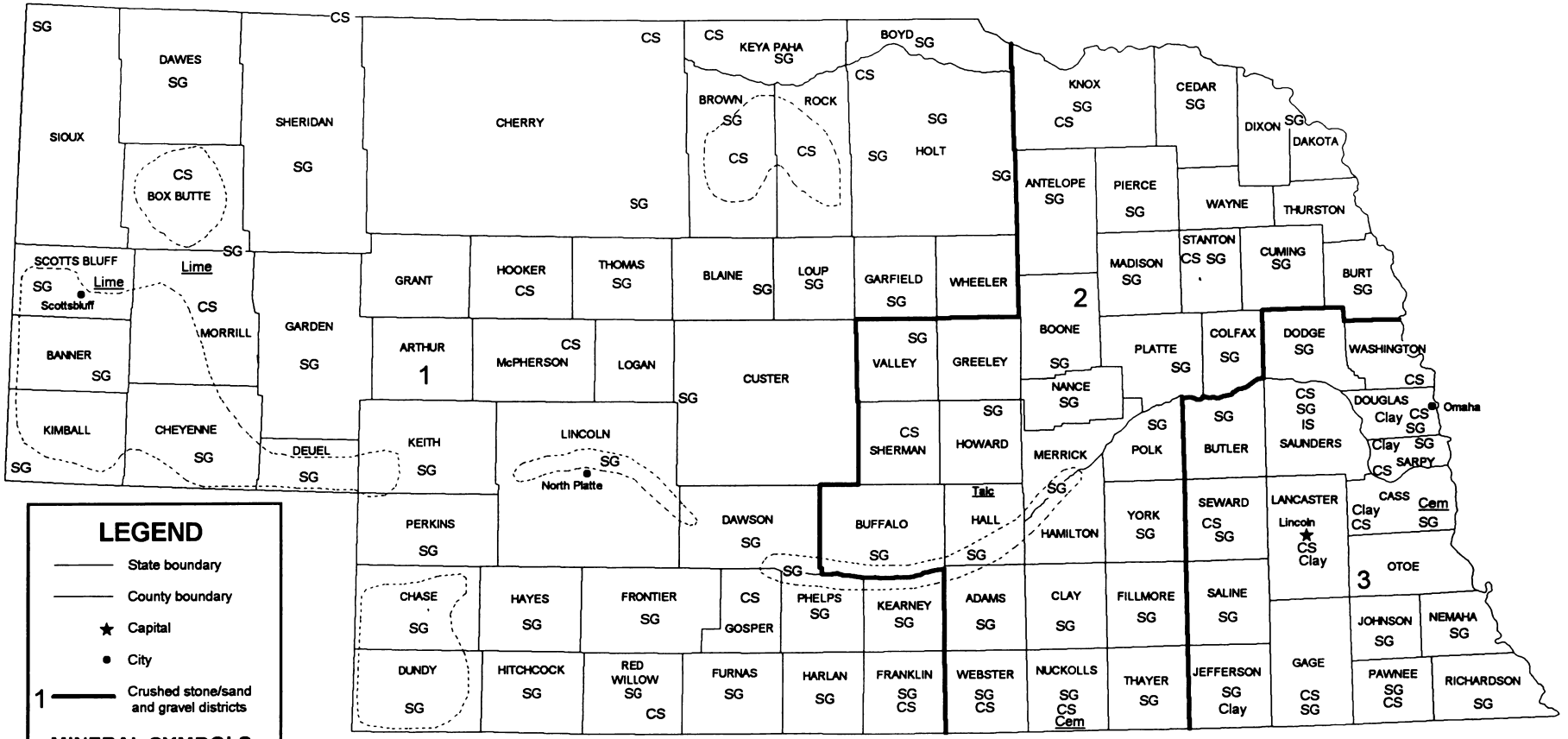
NEBRASKA



LEGEND

- State boundary
- County boundary
- ★ Capital
- • City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Cem	Cement plant
Clay	Clay
CS	Crushed stone
IS	Industrial sand
Lime	Lime plant
SG	Sand and gravel
Talc	Talc plant
	Concentration of mineral operations

CS and SG symbols often represent numerous locations within a county, and not a specific location.

0 50 Kilometers

Source: University of Nebraska-Lincoln, Nebraska Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF NEBRASKA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the University of Nebraska-Lincoln, Nebraska Geological Survey, for collecting information on all nonfuel minerals.

In 1997, for the 4th consecutive year, Nebraska ranked 41st among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $161 million, a 9% increase from that of 1996. This followed a 1.4% increase from 1995 to 1996 (based on final 1996 data). The State accounted for a little less than 0.5% of the U.S. total nonfuel mineral production value.

The State's leading nonfuel minerals by value were crushed stone, construction sand and gravel, and portland cement. In 1997, Nebraska's increase in value was mostly accounted for by increases in construction sand and gravel, crushed stone (*table 1*), and portland cement. All other nonfuel minerals had small increases except industrial sand and gravel, which remained virtually the same. Common clays showed a small decrease relative to the changes in the leading commodities. Compared to that of 1997, the less vibrant increase in the State's nonfuel mineral value from 1995 to 1996 was mainly attributable to the small decreases in construction sand and gravel and crushed stone (*table 1*), mitigating an overall larger increase in portland cement. Metals produced in the State, mostly raw steel, were processed from materials acquired from other domestic and foreign sources. Uranium was in situ leach mined at one location in northwestern Nebraska but is not included in USGS statistics because it is a fuel mineral.

The following narrative information was provided by the Nebraska Geological Survey[2] (NGS). Geologists from 10 States and the U.S. Geological Survey continued investigative studies of the Missouri River Basin regarding 3 main areas of concern: the urban-rural corridor from Omaha to Kansas City, MO; issues related to mining; and the effect of agriculture. The project brings together geologists from State Geological Surveys in Colorado, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota, Wyoming, and the U.S. Geological Survey. The effort will produce a large data-base with maps and references for finding various kinds of information about the basin including details about geology and mineral resources.

ASARCO Incorporated completed the shutdown of its Omaha lead refinery. The last lead production took place in mid-1996, although a small quantity of bismuth was produced in early 1997. The Omaha plant began operations in 1899, refining lead bullion produced by the company's facility in East Helena, MT.

Interest in reopening an old chalk mine in the central part of the State as a tourist attraction continued during the year. Mining operations dated from 1869 to the early 1950's. The mine was left open for picknickers and tourists until 1978 when the entrance collapsed.

The NGS produced several mining-related publications which were published by Nebraska's Conservation and Survey Division, including a 1997 update of *Mineral Facts for Nebraska*, *Industrial Mineral Resources of Nebraska* (included in *Proceedings of the 32nd Annual Industrial Minerals Forum*), and water and mineral test-hole log books for holes drilled in Franklin, Washington, and Webster Counties. Information concerning these and other State geologic publications is available from the NGS.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (e.g., construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Raymond R. Burchett, Research Geologist, authored the text of mineral industry information submitted by the Nebraska Geological Survey.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN NEBRASKA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays, common	232	1,130	277	1,140	189	601
Gemstones	NA	W	NA	3	NA	3
Lime	20	803	13	553	13	565
Sand and gravel, construction	13,700	47,100	12,900	44,300	14,300	50,500
Stone, crushed	6,590	41,800	6,370	39,800	7,000	45,000
Combined value of cement, gemstones, sand and gravel (industrial), and value indicated by symbol W	XX	55,500	XX	62,100	XX	64,500
Total	XX	146,000	XX	148,000	XX	161,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
NEBRASKA: CRUSHED STONE SOLD OR USED, BY KIND 1/

(Thousand metric tons)

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	11	6,590	$41,800	$6.34	11	6,370	$39,800	$6.25

1/ Data are rounded to three significant digits.

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TABLE 3
NEBRASKA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	135	$1,280	$9.51
Coarse aggregate, graded, concrete aggregate, coarse	838	6,120	7.30
Fine aggregate (-3/8 inch):			
Other fine aggregate	4	12	3.00
Coarse and fine aggregates:			
Upaved road surfacing	292	2,360	8.07
Crusher run or fill or waste	457	3,240	7.08
Other coarse and fine aggregates 3/	616	3,510	5.69
Agricultural, agricultural limestone 4/	316	2,740	8.67
Chemical and metallurgical:			
Cement manufacture	(5/)	(5/)	4.15
Flux stone	(5/)	(5/)	6.00
Special, asphalt fillers or extenders	(5/)	(5/)	17.50
Unspecified; actual 6/	2,150	14,000	6.53
Total	6,370	39,800	6.25

1/ Includes limestone.
2/ Data are rounded to three significant digits except unit value; may not add to totals shown.
3/ Includes bituminous aggregate (coarse), macadam, other coarse aggregate, pipe bedding, and stone sand (bituminous mix or seal).
4/ Includes other agricultural uses.
5/ Withheld to avoid disclosing company proprietary data; included in "Total."
6/ Includes production reported without a breakdown by end use.

TABLE 4
NEBRASKA: CRUSHED STONE SOLD OR USED BY
PRODUCERS IN 1996, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

	District 3	
Use	Quantity	Value
Construction aggregates:		
Coarse aggregate (+1 1/2 inch) 3/	W	W
Coarse aggregate, graded 4/	W	W
Fine aggregate (-3/8 inch) 5/	W	W
Coarse and fine aggregate 6/	2,340	16,500
Agricultural 7/	316	2,740
Chemical and metallurgical 8/	(9/)	(9/)
Special 10/	(9/)	(9/)
Unspecified, actual 11/	2,150	14,000
Total	6,370	39,800

W Withheld to avoid disclosing company proprietary data; included with "Coarse and fine aggregate."
1/ No crushed stone was produced in District 1 and 2.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes macadam, other coarse aggregate and riprap and jetty stone.
4/ Includes concrete aggregate (coarse) and bituminous aggregate (coarse).
5/ Includes other fine aggregate and stone sand (bituminous mix or seal).
6/ Includes crusher run (select material or fill), other coarse and fine aggregates, pipe bedding, and unpaved road surfacing.
7/ Includes agricultural limestone and other agricultural uses.
8/ Includes cement manufacture and flux stone.
9/ Withheld to avoid disclosing company proprietary data; included in "Total."
10/ Includes asphalt fillers or extenders.
11/ Includes production reported without a breakdown by end use.

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TABLE 5
NEBRASKA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	1,830	$6,120	$3.35
Plaster and gunite sands	70	342	4.89
Concrete products (blocks, bricks, pipe, decorative, etc.)	143	681	4.76
Asphaltic concrete aggregates and other bituminous mixtures	858	2,610	3.04
Road base and coverings 2/	1,730	5,400	3.12
Fill	568	1,060	1.87
Snow and ice control	77	239	3.10
Other miscellaneous uses 3/	54	252	4.67
Unspecified: 4/			
Actual	814	3,010	3.70
Estimated	6,770	24,600	3.64
Total or average	12,900	44,300	3.44

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes filtration and roofing granules.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 6
NEBRASKA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	386	1,290	1,660	5,860
Asphaltic-bituminous mixtures	377	1,090	480	1,520
Road base and coverings 4/	635	1,580	1,090	3,820
Fill	121	322	447	738
Snow and ice control	24	68	53	172
Other miscellaneous uses 5/	44	191	10	60
Unspecified: 6/				
Actual	112	242	701	2,770
Estimated	643	1,990	6,120 7/	22,600 7/
Total	2,340	6,760	10,600 7/	37,600 7/

1/ Production reported in District 3 was included with "District 2" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Includes road and other stabilization (cement).
5/ Includes filtration and roofing granules.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.
7/ Includes data from unspecified district.

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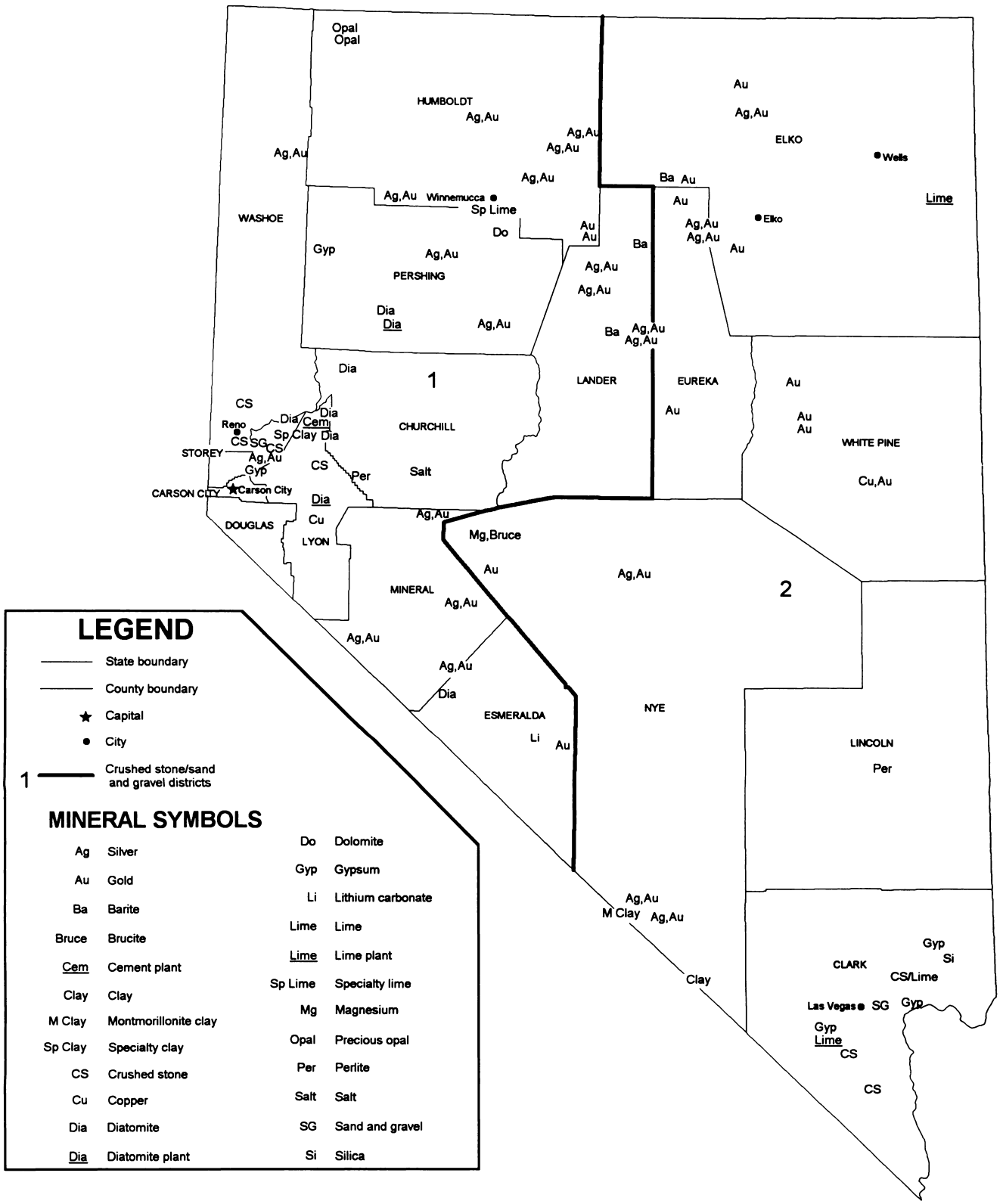
NEVADA



LEGEND

- State boundary
- County boundary
- ★ Capital
- ● City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Ag	Silver	Do	Dolomite
Au	Gold	Gyp	Gypsum
Ba	Barite	Li	Lithium carbonate
Bruce	Brucite	Lime	Lime
Cem	Cement plant	Lime	Lime plant
Clay	Clay	Sp Lime	Specialty lime
M Clay	Montmorillonite clay	Mg	Magnesium
Sp Clay	Specialty clay	Opal	Precious opal
CS	Crushed stone	Per	Perlite
Cu	Copper	Salt	Salt
Dia	Diatomite	SG	Sand and gravel
Dia	Diatomite plant	Si	Silica

0 100 Kilometers

Source: Nevada Bureau of Mines and Geology/U.S. Geological Survey

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THE MINERAL INDUSTRY OF NEVADA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Nevada Bureau of Mines and Geology for collecting information on all nonfuel minerals.

Nevada, the Nation's leading State in gold and silver production, ranked second in 1997 in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). This was the fifth year in the past six in which the State ranked second; in 1993, Nevada was first in the Nation. Nevada mines provided 68% and 42% of the Nation's gold and silver, respectively, and in so doing, the "Silver State" has been first in gold production since 1981 and in silver since 1987. Thirty-two mines reported gold production and 25 mines reported production of silver. The State's total estimated nonfuel mineral value for 1997 was about $3.03 billion, a decrease of about 6% from that of 1996. This followed a 5.6% increase from 1995 to 1996 (based on final 1996 data). The State accounted for almost 8% of the U.S. total nonfuel mineral production value.

In 1997, gold accounted for 82% of Nevada's nonfuel mineral value, but the metal also accounted for the largest portion of the State's decrease in value. Gold production increased, but owing to a lower average price for gold, the metal's total value decreased by about $210 million. Other nonfuel minerals that had significant decreases included construction sand and gravel, lithium minerals, and silver. Copper production increased by an estimated 44%, but its value increase was less owing to decreased copper prices. Smaller value increases also occurred for barite and portland cement. In 1996, substantial increases in the values of copper and gold accounted for a large majority of the increase in value. Significant but more moderate increases in the values of lime, diatomite, lithium minerals, crushed stone, portland cement, and construction sand and gravel (in descending order of relative increase) also contributed to that year's rise in value. Only silver showed any significant decrease in value in 1996.

Based on USGS estimates of quantities produced in the 50 States during 1997, Nevada remained first in gold, silver, and barite production; first of three mercury-producing States; and the only State to produce magnesite and brucite (in descending order of value). The State also retained its 1996 ranking in a number of other mineral commodities—it was second in diatomite, second of two States that produced lithium minerals, fourth of six crude perlite-producing States, and fifth in crude gypsum and zeolites. Nevada moved up in rank to fourth from fifth in copper production. In addition, significant quantities of construction and industrial sand and gravel and lime were produced in the State.

The following narrative information was provided by the Nevada Bureau of Mines and Geology (NBMG).[2] Production data in the following text are those reported by the NBMG, based on its own surveys, canvasses, and estimates. The NBMG data are reported by that agency to be nonproprietary data (Nevada Bureau of Mines and Geology, 1998) and may differ from some USGS preliminary estimates and production figures as reported to the USGS.

Nevada had a record production year for several mineral commodities (Nevada Bureau of Mines and Geology, 1998). The State reached a gold production milestone in 1997—exceeding 243,000 kilograms (7.8 million troy ounces), and for the second consecutive year exceeded the 218,000 kilogram (7 million ounces) mark. According to the NBMG, Nevada is the third largest producer of gold in the world, behind only South Africa and Australia. Silver production also set a new record for the State, exceeding 768 metric tons, breaking the previous record set in 1995 by over 4.35 tons. Silver production has exceeded the 622 ton (20 million ounces) mark for the fifth year in a row. Copper production was up 50% from that of 1996, and lime production also increased nearly 50% over 1996, largely due to increased demand by gold operations for pH control. Gypsum production also increased owing to the construction industry's demand for more wallboard.

The trend of growing production of gold from underground operations that became more firmly established in 1996 continued in 1997. Twenty percent (48,800 kilograms) of Nevada's gold production was mined underground. Barrick Goldstrike's Meikle Mine in Elko County, for the second consecutive year, was the largest underground gold mine in the United States with 17,900 kilograms produced in 1997. New underground mines expected to begin production in 1998 include Getchell Gold's Turquoise Ridge Mine and Midas Joint Venture's Ken Snyder Mine. While open pit mines will continue to produce most of Nevada's gold, underground mines are becoming increasingly important.

Nevada's reported gold reserves stood at about 3.2 million kilograms (103 million ounces) at the end of 1997. These reserves

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

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[2]Joseph V. Tingley and Daphne D. La Pointe, Research Geologists, co-authored the remainder of the text of mineral industry information provided by the Nevada Bureau of Mines and Geology. More detail, especially regarding mineral exploration in Nevada in 1997, may be obtained from their original report. See References Cited section at end of this report.

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were defined by the NBMG as those at or near currently operating mines that can be mined at a profit with reasonably foreseeable economic conditions. With the average price of gold during 1997 somewhat low, many companies had to reevaluate their reserves, and reclassify some as subeconomic resources. Pending a rebound in the price of gold, these subeconomic resources would regain their reserve status. At yearend 1997 gold prices, the existing proven reserves were deemed enough to sustain gold production at then current levels for about 15 years.

For the third year, Barrick Gold's Betze-Post Mine was Nevada's largest gold mine, producing 49,900 kilograms (Tingley and La Pointe, 1998a). Newmont's Carlin trend deposits reported a production of 56,600 kilograms of gold, but this figure is the combined production of several individual mines. Newmont Mining Corp. completed its $2.1 billion merger with Santa Fe Pacific Gold Corp. in May adding the Lone Tree Complex, the Twin Creeks Mine, and half-interest in the Rosebud Mine to the Newmont portfolio of operations. With the acquisition of these mines, Newmont became the State's largest gold-producing company with over 84,000 kilograms of gold production in 1997.

Other major gold producers in 1997 included Smoky Valley Common Operation's Round Mountain Mine, 15,100 kilograms; Placer Dome's Cortez Gold Mines (including the new Pipeline Mine), 12,600 kilograms; Independence Mining Co.'s Jerritt Canyon Mine, 9,705 kilograms; Barrick Gold's Bullfrog Mine, 6,430 kilograms; Echo Bay Minerals Co., 5,820 kilograms from its McCoy-Cove operation; Getchell Gold's Getchell Mine, 5,520 kilograms; and the Florida Canyon Mine of Florida Canyon Mining Co., 5,100 kilograms. Kinross Gold Corp.'s Candelaria Mine, near Hawthorne, produced 1,650 gold equivalent kilograms in 1997. Active mining ceased on the property in the second quarter, but residual leaching operations are expected to continue to the year 2000.

Nevada gold mines that came into production in 1997 included Placer Dome's Pipeline Mine in Lander County, Homestake's Ruby Hill Mine near Eureka, Hecla's Rosebud Mine (production began in April) in Pershing County, and Cornucopia's Mineral Ridge Mine at Silver Peak. Placer Dome commissioned new gold processing facilities for the Pipeline Mine at its 60%-owned Cortez Joint Venture (Kennecott Minerals Co. owns 40%)—the first gold dore was poured in March.

All of Nevada's metal mines suffered to some extent owing to lower metal prices during 1997. The Mineral Ridge Mine (gold) temporarily closed before yearend. Other closures during the year were the Candelaria (silver and gold), Sterling (gold), and Mount Hamilton Mines (gold and silver). Arimetco ceased mining at its Yerington copper operations in November. Many mines, including Newmont's Carlin Trend operations and Getchell Gold's Getchell Mine reduced employee levels and revised their operations to reduce cost.

Three mines contributed most of Nevada's silver production in 1997. Echo Bay's McCoy-Cove operation produced 342 tons, Coeur d'Alene Mines' Rochester Mine produced 208 tons, and Kinross Gold's Candelaria Mine produced 90.2 tons. Other major producers were Kennecott Rawhide Mining Co.'s Denton Rawhide Mine with 34.2 tons, the Hycroft Mine of Hycroft Resources & Development with 14.9 tons, and Smoky Valley Common Operation's Round Mountain Mine with 11.1 tons. Nevada's newest major silver producer, Hecla's Rosebud Mine, produced 10.5 tons.

Copper production by Arimetco International Inc. from its Yerington operation in Lyon County totaled slightly more than 4,760 tons. The Robinson Mine in White Pine County near Ely, operated by BHP Copper North America, completed its first full year of production in 1997 and shipped concentrates containing 62,600 tons of copper to the BHP smelter at San Manuel, AZ. The property has 260 million tons of minable reserves and a projected mine life of 17 years.

Exploration.—As in previous years, 1997 exploration activity in Nevada was concentrated in a broad band across the central and northern parts of the State. Heavy concentrations of activity were reported along the Battle Mountain-Eureka, Getchell, and Carlin "trends," as well as in specific districts, such as Gold Circle (Midas Joint Venture) and Eureka where major discoveries have been made (Tingley and La Pointe, 1998b). Exploration for new deposits, particularly gold, is an ongoing effort by both current producing companies and others not operating mines in the State. About 310 geologists in Nevada were employed in 1997 primarily to explore for mineral properties to be developed into new mines. These geologists, together with their support staff and expenditures on drilling, assaying, travel, and other related costs, represented a significant economic impact, particularly in the rural areas. In 1997, exploration spending in the State totaled about $131 million.

In Churchill County, Echo Bay Exploration in joint venture with Americomm Resources Corp. completed a third round of drilling on its property in the Jessup district and in the northwestern part of the county. They further delineated an area of known mineralization with a shallow gold resource and identified a new resource area. To the southeast, in the Bell Mountain district, Ecu Gold Mining Co. Inc. completed its first phase diamond drilling program on the Bell Mountain property, where known reserves are about 3,420 kilograms of equivalent gold. In the New Pass district (Churchill-Lander County line), White Knight Gold (U.S.) Inc. and Quest U.S.A. Resources Inc. are pursuing a mining venture on Quest's New Pass property. Previous work has indicated a more than 2.81-million-metric-ton gold resource grading 1.89 grams per metric ton (0.055 troy ounces per short ton).

In Elko County, High Desert Mineral Resources completed geologic mapping and geophysical survey work on several properties including the Bell Creek property and the Evans Mine area and limited trench sampling at the Bob Creek property in the Carlin district. In northwest Elko County, Atlas Corp. turned its Doby George property (Aura district) over to Western Exploration and Development Ltd. for $1.6 million, and Crown Resources Corp. continued exploration on its Maggie Summit Project. To the east, Golden Phoenix Minerals investigated the copper, gold, and silver potential of properties in the Contact district. Previous drilling at Contact by Phelps Dodge encountered high-grade intercepts of 10% copper over 12 meters, silver values as high as 439 grams per ton, and gold values as high as 5.14 grams per ton on properties with a reported resource of 227,000 to 454,000 tons of copper. In the Bootstrap district, Barrick Gold Inc. planned exploration of the deeper potential of the Dee gold property owned

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by Rayrock Yellowknife Resources. In the south part of Bootstrap, drilling results from the Ren property of Romarco Minerals Inc. indicated a potential for deep, higher-grade mineralization where structures intersect the favorable Popovich Formation.

In western Elko County, exploration activity was at a high level in the Gold Circle district surrounding the town of Midas. Interest centered at the new Ken Snyder discovery of Euro and Franco Nevada Mining Corp. in the heart of the old district. Exploration and definition drilling continued on the high-grade deposit, now estimated by the company to contain 65,300 kilograms of gold and 715,000 kilograms of silver. On adjacent ground, Romarco Minerals Inc. drilled 57 holes exploring its Midas project where high-grade mineralization was intersected over a 518-meter strike length of the Gold Crown vein. About 96 kilometers northeast of Midas (Island Mountain district), Quest International entered into a joint venture on Aur Resources' Coleman Canyon gold project. Westmont Gold Inc. previously explored the property and encountered significant gold mineralization, with gold grades ranging as high as 6.41 grams per ton. Core drilling at the Ivanhoe property of Great Basin Gold Ltd. and Cornucopia Resources Ltd. intersected a northwest-trending structural system hosting epithermal, multi-stage quartz veins containing visible gold and silver mineralization. The structure intersected is in upper plate Valmy Formation rocks and is believed to be a feeder system for the overlying 93,300-kilogram gold resource of the Hollister deposit. The two companies plan to pursue exploration of the Valmy targets. Three companies were active in the Snowstorm Mountains district. Oro Nevada Resources Inc. completed one hole on the Knolls target to test a Controlled Source Audio Magnetotelluric (CSAMT) resistivity high—testing results were negative.

In Esmeralda County, two targets were tested in 1997 by Camnor Resources Ltd. on its Alum district property, southwest of Tonopah. The three holes drilled intersected extensive zones of anomalous silver, gold, mercury, arsenic, and molybdenum in altered rocks, but no economic grades were found. To the northeast, Dia Met Minerals Ltd. commenced Air-Track drilling on its Weepah (district) property in August. Southwest of Goldfield, Cascade Metals Inc. completed preliminary mapping and sampling on the contiguous Florida-Wisconsin, Mozart, and Texas projects in the Lida district and has staked an additional 120 lode claims. In June, Cornucopia Resources Ltd. poured its first gold at the new Mineral Ridge Mine in the Silver Peak district, but in November the company announced the temporary suspension of mining operations owing to depressed metal prices. Eastfield Resources explored two properties near Tonopah. The Three Hills property, containing an estimated gold resource of 5.7 million tons grading 0.788 grams per ton, was explored for high-grade vein and bulk tonnage potential—several surface targets remaining to be drill tested. South of Tonopah, Prism and Eastfield Resources outlined a gold resource of 1.45 million tons grading 0.89 grams per ton on the Hill of Gold property (Divide district). A number of property targets remained to be tested.

In Eureka County, Barrick Gold Exploration Inc. purchased more than 90% of Atlas's Gold Bar properties from Atlas Corp. with an option to acquire the balance within 2 years. The Gold Bar claim block covers about 161 square kilometers in the Antelope district and contains the Gold Bar mill. In the Eureka district, Alta Gold Co. acquired the 1,820-hectare Lookout Mountain property, south of the town of Eureka, from Echo Bay Mines; Uranez and Cambior completed significant amounts of drilling on the New York Canyon and Hoosac property of High Desert Mineral Resources Inc.; European American Resources announced encouraging drill results from its Prospect Mountain property just outside the town; and Echo Bay Mines stepped up exploration on its Ratto Canyon property. The major property in the Eureka district was Homestake Mining Company's new Ruby Hill Mine. Homestake continued exploration in the immediate area, and a deep drilling program was planned to further define the zone of high-grade sulfide mineralization discovered in 1996 some 457 meters below the West Archimedes open pit. At yearend, Ruby Hill proven and probable reserves stood at 6.38 million tons grading 3.36 grams per ton of gold plus 6.51 million tons of mineralized material grading 2.51 grams per ton of gold.

On the northern border of Eureka County (Lynn district), exploration and development activity continued at a high pace. The Newmont-Barrick HD Venture planned preparation of an Environmental Impact Statement on the Leeville Project where proposed mining operations would take place until the year 2017. High Desert Mineral Resources Inc. and the Barrick Gold Venture (a partnership of Newmont and Barrick) explored the Micron and Golden Boy claims, and Newmont Gold intercepted high-grade gold values in a deep drilling program south of its Post deposit in the northern part of the district. The holes tested the lower-plate rocks below the Roberts Mountains thrust and are considered to be the deepest holes ever drilled in the Carlin Trend. At Rock Creek on the southeast flank of the Sheep Creek Range northeast of Battle Mountain, Altaur Gold optioned a 60% interest in the Rock Creek gold property from Brancote U.S. Inc. of Reno. Previous Rock Creek exploration outlined a small gold resource of about 726,000 tons grading 1.54 grams per ton.

In Humboldt County, the results of a 25-hole drill program on the Converse gold property (Buffalo Mountain district) by Uranerz, Inc. doubled that gold resource. The company has now outlined 39 million tons grading 0.686 grams per ton of gold in the main area of mineralization with an additional 6.4 million tons at the same grade delineated in an open extension of the zone to the north. At the Turquoise Ridge and Getchell Underground deposits at Getchell Gold Corp.'s Getchell Mine in the Potosi district, a net 49,800 contained kilograms of proven and probable gold reserves were added in 1997 to previous company estimates. Total gold reserves at yearend were 193,000 contained kilograms, including proven and probable underground reserves of 190,000 kilograms with an average grade of 13 grams per ton. In the southern part of the district, exploration on the Barrick Gold Corp.-Homestake Mining Co. Pinson Mine property identified new open pit reserves that may extend the mine life. Mustang Gold Corp. conducted geologic mapping, sampling, and ground geophysics at its Pearl Canyon property in the Varyville district. A first-phase reverse circulation drill program completed at the Roberts Polymetallic Zone intersected significant amounts of copper and silver over a 305-meter strike length—additional drilling was planned.

In Lander County (Battle Mountain district), Battle Mountain

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Gold Co. increased total estimated proven and probable gold reserves at the Phoenix property to 77,900 kilograms. Additional drilling is planned for the Fortitude, Midas, and Phoenix deposits in 1998 in an effort to further expand estimated reserves. In the southwest part of the Battle Mountain district, Consolidated North Coast Industries Ltd. planned to explore the Wilson Independence property near Copper Canyon where prior exploration has indicated a resource of over 24,800 kilograms of gold. In the Buffalo Valley district, west of Battle Mountain, Fairmile Gold Corp. reported that drilling at its Buffalo Valley Project increased the total gold resource to 18,700 kilograms. The Cortez Joint Venture also completed an extensive drilling program on the west side of Coral Gold's Robertson property in Crescent Valley and continued exploration at the South Pipeline project. Exploration drilling at Echo Bay's McCoy-Cove in the McCoy district south of Battle Mountain hit additional gold mineralization that could potentially extend the life of the mine by one or more years.

In Lyon County, GLS Global Assets and Adamas Resources obtained encouraging results from their sampling program on the Hydra-Hercules gold and silver property in the Como district. The property contains a geologic resource estimated by previous operators to be between 3,640 kilograms and 6,630 kilograms of gold and over 46,700 kilograms of silver.

In Mineral County, in the Aurora district, Nevada Consolidated Goldfields, operator of the Aurora Mine, recently acquired the neighboring Aurora Partnership property, which could add 5,600 kilograms (180,000 oonces) of gold to reserves at the Aurora Mine. West of Aurora, in the Borealis district, Cambior Exploration USA Inc. has budgeted $500,000 for exploration on the Borealis Mine property in 1998. Cambior's exploration and development drilling program will include continued work on the Graben-Freedom Flats sulfide resource, reported by the company to contain an estimated 6,380 kilograms of gold. In the Rawhide district, Kennecott Exploration proceeded in areas adjacent to the Denton-Rawhide Mine, where reserves are reported by Kennecott to stand at about 13,900 kilograms of gold and 121,000 kilograms of silver to be produced over the next 5 years.

In Nye County near Beatty, Inter-Rock Gold Inc. reported that revised minable reserves at the Daisy Mine (Bare Mountain district) now stand at 15.7 million tons grading 0.823 grams per ton. The revised figures incorporate both sulfide gold mineralization and additional oxide mineralization outlined by early 1997 drilling. To the west, in the Bullfrog district, JABA Inc., of Tucson, AZ, announced plans for core drilling on its Providence claims, located adjacent to Barrick Gold's Bullfrog Mine. Miranda Industries Inc. announced completion of the first phase of drilling at its Secret Basin project in the Cloverdale district. Owing to the results, Miranda staked additional claims and now has 80 claims in the area.

In the Golden Arrow district, Tombstone Explorations acquired the Golden Arrow project (composed of 16 patented and 419 unpatented claims) from Kennecott Explorations and commenced drilling late in 1997. Previous operators estimated a resource of 11.3 million tons at 1.34 grams per ton of gold from two zones at Golden Arrow.

The Round Mountain Gold Mine of Echo Bay Minerals and Homestake Mining Co. at Round Mountain adopted a new, optimized open pit plan, eliminating the mining of lower-grade, higher-cost sulfide material. This reduced the mine's proven and probable reserves by about 37,300 kilograms of gold to 364 million tons of ore grading 0.617 grams per ton of gold plus 129 million tons mineralized material grading 0.549 grams per ton of gold.

Royal Gold, Inc. entered into exploration and lease purchase option agreements with New Concept Mining, Inc. and Nevada Manhattan Mining, Inc. on properties in the Manhattan district. According to the company, the New Concept property contains proven and probable reserves of 1.54 million tons grading 4.46 grams per ton of gold and a total resource of 4.8 million tons at an average grade of 6.5 grams per ton of gold, mostly from underground resources. South of Manhattan, in the Rye Patch district, Tombstone Explorations acquired the Midway property from Kennecott Explorations. Kennecott completed 132 reverse-circulation and 4 diamond drill holes on the property and identified a preliminary resource of 8,400 kilograms of gold.

In Pershing County, falling gold prices prompted Kinross Goldbanks Mining Co. to put off the start of its Goldbanks Mine in the Goldbanks district, south of Winnemucca, until the spring of 1999. Development and exploration activities in the Radio Tower East, Jasperoid Hill, Cone, and Headwaters areas of the Florida Canyon property in the Imlay district resulted in additions to the property's gold resource estimate. According to the company, the Florida Canyon property has proven and probable reserves of 41.3 million tons grading 0.823 grams per ton of gold along with 111.4 million tons mineralized material grading 0.75 grams per ton of gold. At Hecla's Rosebud Gold Mine (Rosebud district), the company has proven and probable reserves consisting of 1.16 million tons of ore at an average grade of 13.4 grams per ton of gold for a total of nearly 15,600 kilograms of gold. The deposit also contains about 105.7 metric tons of silver.

In Storey County, BMR Gold Corp. completed a drill program at BMR's Comstock Mine in the southern part of the district. The program was designed to expand the Billy the Kid ore body to the east and test continuity of mineralization between the defined ore body and the old Hartford pit to the north-northwest. Seven of twelve reverse-circulation holes intersected ore grade intercepts that will add to proven-probable resources. At present, the Comstock Mine contains 2,630 proven-probable equivalent kilograms of gold.

In Washoe County, Canyon Resources Corp. sold its Mountain View property in the Deephole district near Gerlach for $3 million to Mountain View Gold, Inc. According to the company, the Mountain View property, acquired in 1992 by Canyon Resources, contains an estimated resource of 19 million tons of 0.926 grams per ton of gold lying beneath 30 meters to 180 meters of gravel to the west of the Granite Mountains. Canyon and Homestake Mining Co. drilled a total of 186 holes while evaluating the Mountain View discovery and searching unsuccessfully for other mineralized areas on the property. To the north, in the Leadville district, Royaledge Resources Inc. completed a 10-hole drilling program on its Hog Ranch property, a joint venture with Cameco U.S. Inc. Two small gold resources on the property, identified by the previous operator, were reported by the companies to contain an estimated 2,400 kilograms of gold.

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Alta Gold Co. increased its land position adjacent to its Olinghouse Mine, east of Reno, by more than 50% by staking 140 additional mining claims in an area previously withdrawn by the Federal Government. Geochemical work in the new lands defined 10 drill targets, 2 of which are defined by anomalies, each more than 610 meters in length and 512 meters in width.

In White Pine County, Alta Gold Co. has an agreement with Osceola Gold Mining Co. to develop gold properties covering about 730 hectares in the Osceola district. Alta Gold's initial drilling is focusing in the area around the old Gilded Age Mine. During 1997, reports of proven and probable gold reserves at Alta Gold's Griffon property were expanded by the company by more than 40% to nearly 3,100 kilograms (100,000 ounces). of gold and mine life extended by at least 1 year. Site development at Griffon began in July and mining commenced in September with production scheduled for January 1998. A more detailed accounting of Nevada exploration activities may be found in the authors' original report (Tingley and LaPoint, 1998b).

NBMG, in collaboration with the Nevada Division of Minerals in the Department of Business and Industry, produces two special publications on the mining industry in Nevada each year. "Major Mines of Nevada" is released in the spring and includes names, addresses, telephone numbers, location maps, and production and employment statistics of the major producers. "The Nevada Mineral Industry" is released near the end of the summer as a 50-plus-page publication covering exploration, development, and production activities for the year in metals, industrial minerals, oil and gas, and geothermal power. It also includes a directory of mining and milling operations and a table with resource figures and cumulative production statistics and geologic data for major gold and silver deposits in Nevada. Both publications are available for sale by NBMG and for free on the World Wide Web (http://www.nbmg.unr.edu).

References Cited

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Tingley, J.V., and La Pointe, D.D., 1998a, Annual review 1997—The United States 1997—Nevada: Mining Engineering, v. 50, no. 5, May, p. 92-96.

———1998b, Nevada 1997, Nevada Bureau of Mines and Geology, March 1998, 18 p.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN NEVADA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995		1996		1997 p/	
		Quantity	Value	Quantity	Value	Quantity	Value
Clays:							
Bentonite		6	477	6	580	29	352
Kaolin		W	W	25	W	34	W
Copper 3/		6	19,800	W	W	W	W
Gemstones		NA	306	NA	234	NA	224
Gold 3/	kilograms	210,000	2,620,000	213,000	2,680,000	226,000	2,470,000
Sand and gravel, construction		22,500	110,000	22,400	113,000	18,200	93,700
Silver 3/	metric tons	693	115,000	605	101,000	676	94,600
Stone, crushed		2,410	21,400	3,080	25,200	2,900	24,000
Combined value of barite, brucite, cement (portland), clays (fuller's earth), diatomite, gypsum (crude), lime, lithium minerals, magnesite, mercury, perlite (crude), salt, sand and gravel (industrial), and values indicated by symbol W		XX	180,000	XX	315,000	XX	350,000
Total		XX	3,060,000	XX	3,230,000	XX	3,030,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Recoverable content from ores, etc.

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TABLE 2
NEVADA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone	6	1,610	$13,300	$8.30	8	2,170	$15,600	$7.17
Dolomite	3	W	W	10.36	3	W	W	14.70
Granite	1	W	W	12.63	1	W	W	12.51
Traprock	1	W	W	4.26	6	W	W	3.30
Volcanic cinder and scoria	1	W	W	2.28	1	W	W	2.20
Miscellaneous stone	1	W	W	4.68	1	W	W	4.41
Total	XX	2,410	21,400	8.90	XX	3,080	25,200	8.18

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits except unit value; may not add to totals shown.

TABLE 3
NEVADA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/ 3/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate, graded;			
Concrete aggregate, coarse	684	$6,190	$9.04
Bituminous aggregate, coarse	112	559	4.99
Other graded coarse aggregate	50	138	2.76
Coarse and fine aggregates:			
Graded road base or subbase	294	1,300	4.43
Crusher run or fill or waste	45	235	5.22
Other construction materials 4/	259	2,020	7.81
Agricultural 5/	W	W	26.20
Chemical and metallurgical 6/	W	W	11.74
Unspecified 7/			
Actual	679	2,960	4.37
Estimated	71	577	8.13
Total	3,080	25,200	8.18

W/ Withheld to avoid disclosing company proprietary data; included in "Total."
1/ To avoid disclosing company proprietary data, no district tables were produced for 1996.
2/ Includes dolomite, granite, limestone, miscellaneous stone, traprock, and volcanic cinder and scoria.
3/ Data are rounded to three significant digits except unit value; may not add to totals shown.
4/ Includes pipe bedding, riprap and jetty stone, stone sand (concrete), and terrazzo and exposed aggregate.
5/ Includes agricultural limestone and other agricultural uses.
6/ Includes flux stone, lime manufacture, and sulfur oxide removal.
7/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
NEVADA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	1,920	$13,500	$7.06
Plaster and gunite sands	359	1,450	4.04
Concrete products (blocks, bricks, pipe, decorative, etc.)	329	1,400	4.24
Asphaltic concrete aggregates and other bituminous mixtures	3,130	15,700	5.00
Road base and coverings 2/	5,850	27,800	4.75
Fill	1,400	4,300	3.07
Snow and ice control	50	226	4.52
Other miscellaneous uses 3/	117	812	6.94
Unspecified: 4/			
Actual	4,790	27,000	5.63
Estimated	4,500	20,500	4.56
Total or average	22,400	113,000	5.02

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes filtration and railroad ballast.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
NEVADA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	757	3,960	1,850	12,400
Asphaltic concrete aggregates and road base materials 3/	2,590	12,200	7,840 4/	35,800 4/
Other miscellaneous uses 5/	110	768	7	44
Unspecified: 6/				
Actual	7	59	4,780	26,900
Estimated	1,720	6,940	2,770	13,600
Total	5,190	23,900	17,200 4/	88,700 4/

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill, road and other stabilization (cement), and snow and ice control.
4/ Includes production within state with no districts reported.
5/ Includes filtration and railroad ballast.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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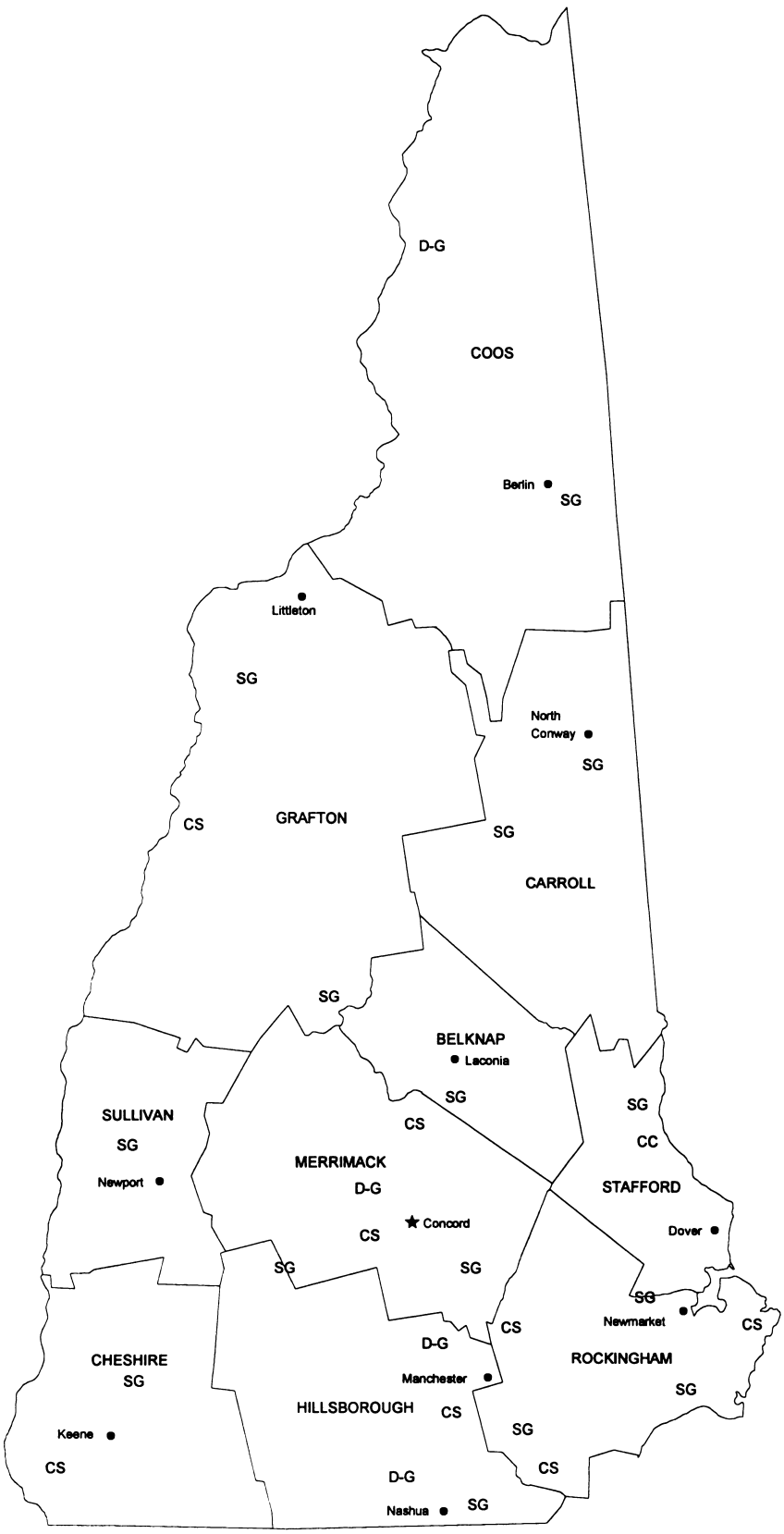
NEW HAMPSHIRE



LEGEND

State boundary

County boundary

★ Capital

● City

MINERAL SYMBOLS

CC	Common clay
CS	Crushed stone
D-G	Dimension granite
SG	Sand and gravel

0 20 Kilometers

Source: New Hampshire Department of Environmental Services/U.S. Geological Survey

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THE MINERAL INDUSTRY OF NEW HAMPSHIRE

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the New Hamphsire Department of Environmental Services for collecting information on all nonfuel minerals.

In 1997, New Hampshire ranked 47th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was more than $60 million, a 16% increase from that of 1996. This followed a 3.8% increase from 1995 to 1996 (based on final 1996 data). The State accounted for less than 0.5% of the U.S. total nonfuel mineral production value.

Construction sand and gravel, a high-volume, low-value mineral commodity, was New Hampshire's leading nonfuel mineral commodity, accounting for about 70% of the value. Crushed stone was the State's second leading nonfuel mineral. In 1997, the increases in both mineral commodities accounted for virtually all of New Hampshire's increase in nonfuel mineral value. In 1996, most of the State's value increase resulted from the rise in the value of construction sand and gravel.

A variety of publications related to New Hampshire's nonfuel mineral resources and markets were available for purchase from the State government. Information regarding the cost and ordering procedures for any of these publications may be obtained through the Office of the State Geologist, or over the Internet at http://www.state.nh.us/des/noframes/2publink.htm/. The publications are as follows: *Construction aggregate resources of New England: An analysis of supply and demand: Boston, Mass.*, New England Governors' Conference, Inc., 1995 (both full report and executive summary); *New Hampshire sand and gravel resources: Boston, Mass.*, New England Governors' Conference, Inc., 1993, including three map sheets, scale 1:250,000; *Construction aggregate demand in the New England States: Boston, MA.*, New England Governors' Conference, Inc., 1992; and *Bibliography and Index of New Hampshire Geology* (selected from publications indexed in GeoRef data base by American Geologic Institute), New Hampshire Department of Environmental Services, Geological Survey, 1991.

Also available are several surficial geologic maps published in 1997 as open file reports (OFR): a map of the Mount Pawtuckaway quadrangle, Rockingham County, NH: NH Geologic Survey OFR-97-1, and a second map of the Penacook quadrangle, Rockingham County, NH: NH Geological Survey, OFR-97-2. Additionally, a series of peat resource maps is available.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. Construction sand and gravel and crushed stone estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country –also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN NEW HAMPSHIRE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Clays, common		3	16	3	16	--	--
Gemstones		NA	9	NA	6	NA	6
Sand and gravel, construction		7,190	34,300	7,620	36,500	8,690	42,700
Stone:							
Crushed 3/		2,150	9,150	1,430	8,650	1,800	11,000
Dimension	metric tons	23,000	6,290	29,000	6,500	29,200	6,540
Total 4/		XX	49,800	XX	51,700	XX	60,200

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones, values which must be concealed to avoid disclosing company proprietary data.
4/ Partial total, excludes values which must be concealed to avoid disclosing company proprietary data.

TABLE 2
NEW HAMPSHIRE: CRUSHED STONE SOLD OR USED, BY KIND 1/ 2/

	1995				1996			
Kind	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Granite	3	974	$3,510	$3.60	3	779	$3,890	$4.99
Traprock	7	1,180	5,640	4.79	8	649	4,760	7.33
Total	XX	2,150	9,150	4.25	XX	1,430	8,650	XX

XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excludes limestone from State total to avoid disclosing company proprietary data.

TABLE 3
NEW HAMPSHIRE: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregates graded:			
Bituminous aggregate, coarse	345	$2,700	$7.84
Bituminous surface-treatment aggregate	174	1,150	6.62
Fine aggregate (-3/8 inch), stone sand, bituminous mix or seal	70	465	6.64
Coarse and fine aggregates, graded road base or subbase 3/	368	2,290	6.23
Unspecified: 4/			
Actual	50	219	4.38
Estimated	422	1,820	4.30
Total	1,430	8,650	XX

XX Not applicable
1/ Includes granite and traprock; excludes limestone from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes concrete aggregate (coarse), macadam, other coarse aggregate, screening (undesignated), and stone sand (concrete).
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
NEW HAMPSHIRE: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996, BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products 2/	1,260	$7,280	$5.80
Asphaltic concrete aggregates and other bituminous mixtures	295	1,190	4.02
Road base and coverings 3/	1,210	5,340	4.41
Fill	1,100	2,750	2.51
Snow and ice control	432	1,230	2.84
Railroad ballast	117	748	6.39
Other miscellaneous uses 4/	59	394	6.68
Unspecified: 5/			
Actual	403	2,980	7.39
Estimated	2,760	14,600	5.30
Total or average	7,620	36,500	4.79

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement).
4/ Includes filtration.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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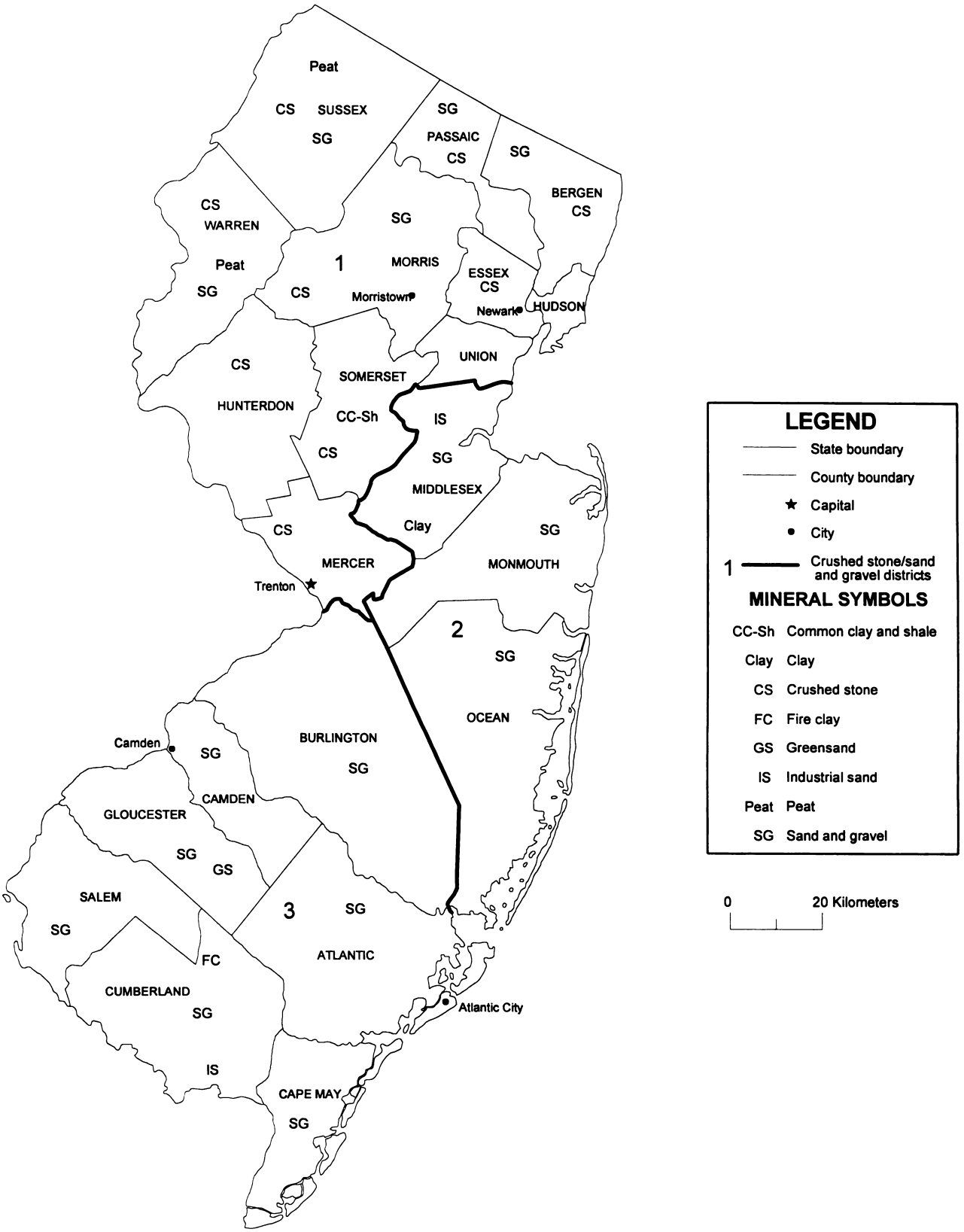
NEW JERSEY



Source: New Jersey Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF NEW JERSEY

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and New Jersey Geological Survey for collecting information on all nonfuel minerals.

In 1997, New Jersey ranked 37th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The State was 38th in 1996. The estimated value for 1997 was $296 million, a 20% increase from that of 1996. This followed a 1.2% increase from 1995 to 1996 (based on final 1996 data). The State accounted for more than 0.5% of the U.S. total nonfuel mineral production value.

Crushed stone and construction sand and gravel, by value, were New Jersey's leading nonfuel mineral commodities. In 1997, these two commodities increased in value by about $18 million and $28 million, respectively, accounting for most of the State's increase in value. Industrial sand and gravel, greensand marl, and peat also increased in value (*table 1*). In 1996, the value of crushed stone increased more than the value of construction and industrial sand and gravel decreased, resulting in the State's net gain for the year.

Based on USGS estimates of the quantities of minerals produced in the 50 States in 1997, New Jersey remained the only producer of greensand marl. Greensand is used directly as an organic conditioner/fertilizer for soils and as a water softening, filtration medium to remove soluble iron and manganese from well water. Although production of industrial sand increased slightly, the State dropped in rank to sixth from fourth. Additionally, New Jersey's quarries and pits produced significant quantities of crushed stone and construction sand and gravel.

The following narrative information was provided by the New Jersey Geological Survey[2] (NJGS). Most New Jersey mining and exploration activities continued to be limited to sand and gravel and crushed stone production. Some clay, greensand, and peat mining was ongoing, but was of relatively minor importance.

Sand and gravel exploration and development remained the most active area of interest in the State. Offshore exploration and development activities were ongoing in New Jersey's coastal waters, where interest in beach replenishment sand and industrial sand and gravel continued to be strong. The U.S. Army Corps of Engineers and the New Jersey Department of Environmental Protection (NJDEP) are committed to several long-term beach replenishment projects along the Atlantic Coast. The New Jersey Geological Survey in cooperation with the U.S. Department of the Interior, Minerals Management Service, continued to locate and document offshore sand and heavy mineral occurrences. Amboy Aggregates remains the only large scale commercial producer of sand and gravel from New Jersey waters, where they have been active since 1985. Working under a U.S. Army Corps of Engineers maintenance dredging permit, the company has been engaged in mining the Ambrose shipping channel in Raritan Bay (near Middlesex County). Because of a decreasing coarse sand fraction in the areas being dredged, the company began blending in crushed stone from rock quarries in Morris, Passaic, and Somerset Counties, in order to meet customer specifications. The dredged sand and gravel and quarried crushed stone are sized and blended in their South Amboy (Middlesex County) processing plant before being shipped by barge and truck to customers throughout the region.

In July, OENJ Corp., through Walsh Remedial Construction Services L.L.C., submitted a preapplication to the NJDEP, detailing innovative uses for suitable dredged materials for construction of infrastructure. OENJ has been making use of dredged material to cap an existing landfill and provide sublevel support for vehicle access and parking in the construction of the MetroMall in Elizabeth, NJ. This project received approval from the NJDEP as a beneficial use for the disposal and containment of dredged material, as both landfill cover and suitable construction material.

Large-scale capital projects contributed to a healthy construction sector in New Jersey. Several major road widening and realignment projects started around the State, including work in Atlantic City on major road improvements. Atlantic City casinos and the Atlantic City International Airport are also involved in major construction and expansion projects. The new Atlantic City Convention Center was completed in May.

Mergers and takeovers during the year included sale of The Morie Company Inc. by South Jersey Industries Inc. to the Unimin Corp. for approximately $55 million. Morie, headquartered in Millville, NJ, is an important sand and gravel producer in the State. Weldon Materials Inc. bought the Tarmack America Inc. Lake Hopatcong, NJ, granite quarry. Medusa Minerals Co. purchased Lime Crest Corp., an important crushed marble and agricultural limestone producer in the State.

Heavy mineral placer mining activity remained inactive during the year. No new land-based mining operations of any significance

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Lloyd Mullikin, Supervising Geologist with the New Jersey Geological Survey, authored the text of New Jersey mineral industry information submitted by that agency.

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started up during 1997.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN NEW JERSEY 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays, common	82	135	74	125	W	W
Gemstones	NA	1	NA	1	NA	1
Sand and gravel:						
Construction	14,000	80,300	13,200	70,400	18,000	98,500
Industrial	1,760		1,680	30,300	1,720	30,500
Stone, crushed	21,000	132,000	21,400	145,000	23,800	163,000
Combined value of other industrial minerals and value indicated by symbol W	XX	(3/)	XX	(3/)	XX	4,040
Total	XX	243,000 4/	XX	246,000 4/	XX	296,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Value excluded to avoid disclosing company proprietary data.
4/ Partial total, excludes values which must be concealed to avoid disclosing company proprietary data.

TABLE 2
NEW JERSEY: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit Value
Limestone	1	W	W	$12.02	1	W	W	$12.34
Granite	9	8,690	$67,800	7.80	9	9,330	$75,500	8.09
Traprock	9	9,950	48,900	4.92	9	9,690	56,100	5.79
Sandstone	1	W	W	8.43	1	W	W	5.29
Miscellaneous stone	1	W	W	4.04	1	W	W	4.13
Total	XX	21,000	132,000	6.28	XX	21,400	145,000	6.79

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

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TABLE 3
NEW JERSEY: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	439	$4,100	$9.33
Other coarse aggregate 3/	459	3,690	8.03
Coarse aggregate, graded:			
Concrete aggregate, coarse	795	5,800	7.30
Bituminous aggregate, coarse	965	4,080	4.22
Railroad ballast	626	5,370	8.57
Other graded coarse aggregate 4/	807	7,670	9.50
Fine aggregate (-3/8 inch):			
Stone sand, concrete	W	W	9.66
Stone sand, bituminous mix or seal	152	1,270	8.35
Screening, undesignated	1,420	9,730	6.84
Other fine aggregate	W	W	9.80
Coarse and fine aggregates:			
Graded road base or subbase	1,870	15,900	8.53
Unpaved road surfacing	W	W	7.42
Crusher run or fill or waste	1,070	10,100	9.39
Other coarse and fine aggregates 5/	4,220	37,900	8.98
Unspecified: 6/			
Actual	3,120	16,500	5.29
Estimated	5,480	23,300	4.25
Total	21,400	145,000	6.79

W Withheld to avoid disclosing company proprietary data; included with "Other coarse and fine aggregates."
1/ Includes granite, limestone, miscellaneous stone, sandstone, and traprock.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone.
4/ Includes bituminous surface-treatment aggregate.
5/ Includes roofing granules.
non-respondents.
6/ Includes production reported without a breakdown by end use and with estimates for non-respondents.

TABLE 4
NEW JERSEY: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	4,840	$29,700	$6.14
Plaster and gunite sands	224	1,520	6.79
Concrete products (blocks, bricks, pipe, decorative, etc.)	253	1,520	6.02
Asphaltic concrete aggregates and other bituminous mixtures	2,730	10,700	3.92
Road base and coverings 2/	245	1,600	6.53
Fill	478	1,380	2.89
Snow and ice control	96	546	5.69
Other miscellaneous uses 3/	131	945	7.21
Unspecified: 4/			
Actual	2,920	16,400	5.62
Estimated	1,280	6,010	4.68
Total or average	13,200	70,400	5.33

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes filtration.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 5
NEW JERSEY: CONSTRUCTION SAND AND GRAVEL SOLD OR USED
IN 1996, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 3	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	878	6,190	4,440	26,600
Asphaltic concrete aggregates and road base materials 4/	412	1,450	3,140	12,800
Other miscellaneous uses 5/	125	905	6	40
Unspecified: 6/				
Actual	–	--	2,920	16,400
Estimated	347	1,800	936	4,210
Total	1,760	10,300	11,400	60,000

1/ Production reported in District 2 was included with "District 3" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Includes fill, road and other stabilization (cement), and snow and ice control.
5/ Includes filtration.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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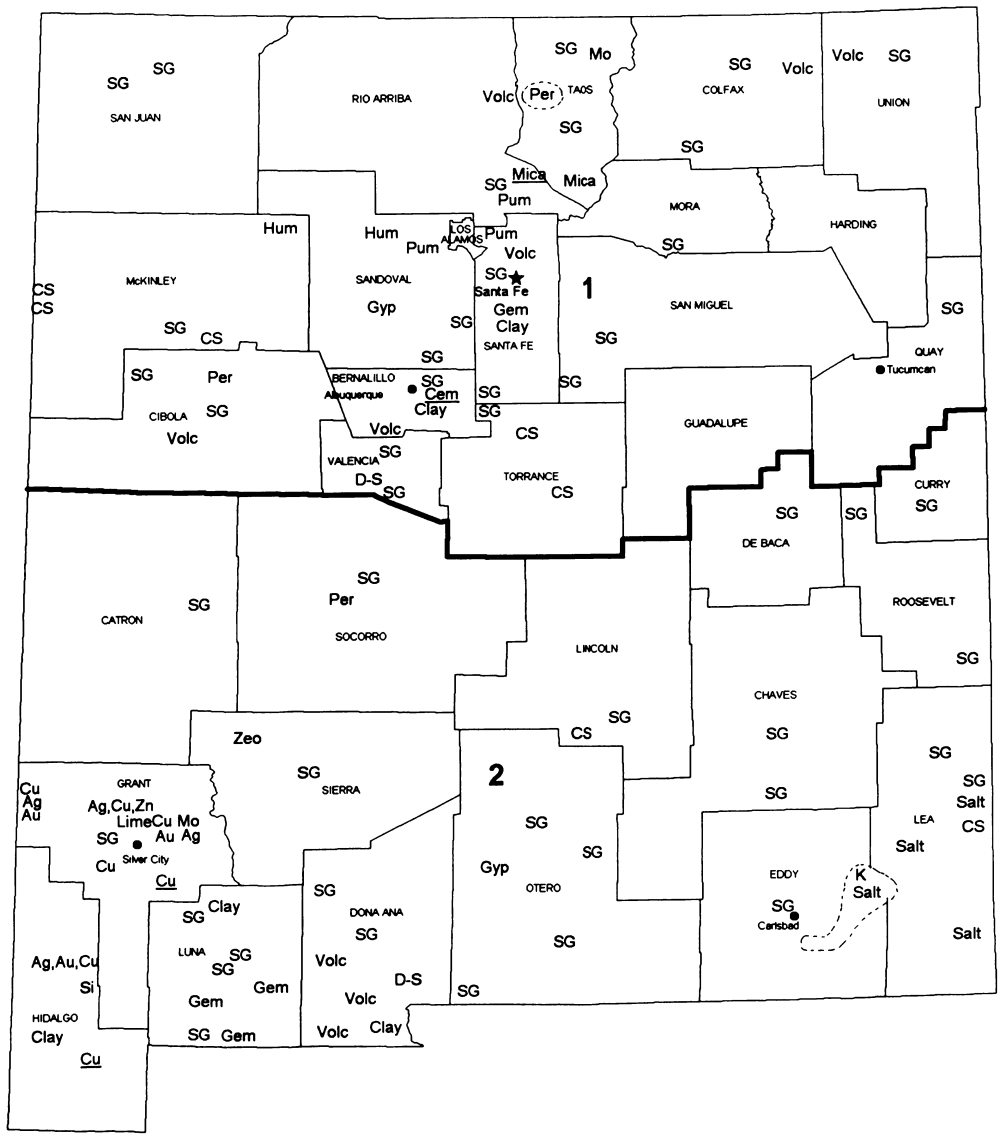
NEW MEXICO



LEGEND

- State boundary
- County boundary
- ★ Capital
- ● City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Ag	Silver
Au	Gold
Cem	Cement plant
Clay	Clay
CS	Crushed stone
Cu	Copper
Cu	Copper plant
D-S	Dimension stone
Gem	Gemstones
Gyp	Gypsum
Hum	Humate
K	Potash
Lime	Limestone
Mica	Mica
Mica	Mica plant
Mo	Molybdenum
Per	Perlite
Pum	Pumice
Salt	Salt
SG	Sand and gravel
Si	Silica
Volc	Volcanic cinder
Zeo	Zeolites
Zn	Zinc
	Concentration of mineral operations

0 100 Kilometers

Source: New Mexico Bureau of Mines and Mineral Resources/U.S. Geological Survey

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THE MINERAL INDUSTRY OF NEW MEXICO

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the New Mexico Bureau of Mines and Mineral Resources for collecting information on all nonfuel minerals.

In 1997, for the second consecutive year, New Mexico ranked 12th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $994 million, virtually the same as that of 1996. This followed a 12.2% decrease from 1995 to 1996 (based on final 1996 data). The State accounted for about 2.5% of the U.S. total nonfuel mineral production value.

Copper and potash, by value, were the top nonfuel minerals mined in New Mexico. Based on final 1996 data, the 2 commodities together accounted for 85% of the State's total nonfuel mineral production value and were 17 times the value of New Mexico's next highest mineral commodity, construction sand and gravel. In 1997, production increases, especially in the values of potash, crude gypsum, portland cement, and crude perlite, compensated for the decreases in copper, crushed stone, construction sand and gravel, and gold. Changes in the other mineral commodities were small relative to these. In 1996, most of the decrease in value resulted from the drop in copper and a relatively smaller decrease in potash (*table 1*). Despite a little more than 2% rise in production, the value of copper declined by about 20% or $150 million, owing to a fall in the price of copper.

Based on USGS estimates of the quantities of minerals produced in the 50 States during 1997, New Mexico continued to lead the Nation in potash, perlite, and zeolites; remained second in crude mica, third in copper, and sixth in molybdenum; and rose to second from third in pumice. In addition, significant quantities of gypsum were mined in the State.

The following narrative information was provided by the New Mexico Bureau of Mines and Mineral Resources[2] (BMMR). Production data in the following text are those reported by the BMMR, based on canvass survey data collected by New Mexico's Department of Energy, Minerals and Natural Resources and related information collected by the BMMR. They may differ from some production figures reported to the USGS. Phelps Dodge Corp. continues to mine copper at Santa Rita and Tyrone, despite the drop in copper prices in 1997. The decline in the value of copper production was primarily the result of a decline in copper prices. The Comex spot price averaged $1.35 per pound in 1995, $1.06 per pound in 1996, $1.04 per pound in 1997.

Phelps Dodges's Chino Mine in Santa Rita produced 90,000 metric tons of copper in concentrate and precipitates and 64,000 tons of copper by solvent extraction/electrowinning (SX/EW) (Phelps Dodge Corp. Annual Report, 1998). Milling reserves were estimated in 1997 at 335 million tons of 0.62% copper and estimated leaching reserves were 472 million tons of 0.3% copper. The Chino Mines Co. employed 1,260 people in 1997 at its mine and smelter and set an annual anode production record of 154,000 tons in 1997. The SX/EW expansion project was also completed in 1997. At Phelps Dodge's Tyrone Mine, leaching reserves (recoverable copper) were estimated as 413 million tons of ore grading 0.34% copper in 1997 (Phelps Dodge Corp. Annual Report, 1998). Copper production by SX/EW in 1997 amounted to 68,000 tons of copper. The Tyrone Mine employs approximately 550 workers.

Mining continued at the Continental Mine in the Fierro-Hanover district, where Cobre Mining Co., Inc. operated through the end of 1997. At yearend, Phelps Dodge Corp. was negotiating the acquisition of Cobre Mining Co., Inc. The acquisition would likely include Cobre's open pit mine, 2 underground mines, 2 mills, and the surrounding 4,500 hectares of land.

Environmental Impact Statements (EIS) were being prepared for expansions at the Santa Rita, Chino, and Continental Mines. In addition, Phelps Dodge Corp. in voluntary cooperation with the New Mexico Environment Department began reclamation at six sites in the Silver City area, which were affected by historic mining. The sites were Whitewater Creek, Hanover Creek, the Lampbright area, the Hurley smelter, the town of Hurley, and the tailings area south of the smelter. The first stage of the reclamation program is to develop a background report defining the problems. Successive stages will involve remedial investigations, a feasibility study, and remedial action.

Opening of the Copper Flat Mine at Hillsboro has been delayed until there is a final decision by the Bureau of Land Management (BLM) on the draft EIS (released February 1996). BMMR held public hearings in late 1996 and a mining permit may be issued in 1998. The Copper Flat deposit, discovered in 1975, contains copper, gold, molybdenum, and silver disseminated in a quartz-monzonite stock and in quartz veins (Dunn, 1982, 1984). Current reserves of the deposit were estimated as 221,000 tons copper, 7.6 tons gold, 100 tons silver, and 7,120 tons molybdenum (Dillard, 1995).

Summo Minerals Corp. of Vancouver applied for mining

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Virginia McLemore, Geologist, authored the information submitted by the New Mexico Bureau of Mines and Mineral Resources.

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permits to mine the Copper Hill deposit in the Picuris district in Taos County. The deposit is near Dixon and would be mined by open pit methods. Preliminary drilling indicated that the deposit could yield 5,000 to 14,000 tons of copper over a 10-year mine life. Exploration is still underway. BLM and the Picuris Pueblo opposed the mine because it is located between two canyons that drain into the Rio Grande and Rio Embudo Rivers—both may receive Wild and Scenic River designations.

Unocal Corp.'s estimated production for 1997 is 6,800 tons of molybdenite. Molybdenum is used to manufacture various metal products, especially steel, and molybdenum disulfide, used as a lubricant. The company also initiated a reclamation and revegetation program to cover overburden dumps at the inactive open pit mine site.

The Lordsburg Mining Co., a subsidiary of The Goldfield Corp., received the BMMR's Excellence in Mine Reclamation Award in 1997 for voluntary cleanup of the Weststar Corp. leaching facility near Lordsburg. In 1989, Weststar, a gold leaching company, went bankrupt and abandoned a 27,000-ton cyanide heap-leach facility. The Lordsburg Mining Co. not only reclaimed the site but was also able to sell the material for aggregate and silica flux in 1995 and 1996. In 1996, the company sold 16,000 tons of barren, siliceous flux ore to copper smelters, but in 1997 there was no silica flux ore sold. In 1997, the Lordsburg Mining Co. sold 22,000 tons of construction aggregate.

The U.S. Environmental Protection Agency began cleanup of lead and arsenic contamination at the inactive Stephenson-Bennett Mine in the Organ Mountains. High levels of lead and arsenic were found in soils in nearby Butterfield Park and one boy reportedly had high levels of lead in his blood (El Paso Times, November 18, 1997). The Stephenson-Bennett Mine is a carbonate-hosted lead-silver and zinc-lead deposit (polymetallic replacement) mined in the 1880's and early 1900's.

St. Cloud Mining Co., a subsidiary of The Goldfield Corp., has operated a zeolite open pit mine in Sierra County since 1990. The mining properties consist of approximately 600 hectares and contain several hundred million tons of reserves (The Goldfield Corp. Annual Report, 1998). Zeolites are altered volcanic ash and clinoptilolite is the predominant mineral. Clinoptilolite is mined, crushed, dried, and sized without beneficiation and shipped in packaged form to meet customer specifications. Markets include cat litter, industrial fillers and absorbents, filtration media, environmental products, animal feed supplements, and soil conditioners. In 1997, St. Cloud sold 13,600 tons of natural zeolite compared with 13,100 tons in 1996 and 18,800 tons in 1995.

Full operation of the El Cajete pumice mine in the Jemez Mountains (Copar Pumice Co.) was delayed until preparation of an EIS (draft released early 1997). The mine opened in 1997 and will operate for 10 years. Reserves are estimated at 90,000 tons of pumice that will be used in making stone-washed jeans. Other mines are active in the region.

Eddy Potash, Inc. closed its potash mines in December as a result of depletion of high-grade ore. Mississippi Potash Co., a subsidiary of Mississippi Chemical Corp., bought Eddy Potash, in August 1996. Mississippi Chemical Corp., IMC Global Inc., and Western Ag-Minerals Co. operate mines in the Eddy County potash district. Langbeinite and sylvite are the primary potash minerals found in Permian evaporates of the Permian Basin. Mining is by underground methods; solution mining is locally used as well. Sodium salt is also produced locally.

At the end of the year, IMC Global was in the process of purchasing Harris Chemical Group, including Great Salt Lake Minerals. In September, IMC Global completed the purchase of Western Ag-Mineral from Rayrock Yellowknife Resources.

A new turquoise mine opened in May 1997—the Lost Mine of Enchantment, near Ruidoso in Lincoln County. The turquoise is green, mottled with brownish streaks, and is being sold for $3 to $15 a carat.

San Pedro Mining Corp. applied for and received a mining permit for industrial grade garnet in November 1996, from the New Mexico Mining and Minerals Division (NMMMD) to reprocess the mine dumps at the San Pedro Mine in Santa Fe County. The State Mining and Minerals Commission upheld the mining permit issued by NMMMD to allow the San Pedro Mine to reopen. The company still must obtain a mining permit from the Santa Fe County Mining Commission. The county claims that mining is not an appropriate use for the area.

Addwest Minerals, Inc.'s Wind Mountain nepheline syenite project in southern Otero County is on hold. The nepheline syenite was to be used as a constituent in amber-colored beverage containers, ceramics, and flatglass.

Improvement in the price of uranium led to the continued operation by Quivira Mining Co., a subsidiary of Rio Algom Ltd. (successor to Kerr McGee Corp.), of mine water recovery of uranium from inactive underground operations at Ambrosia Lake, Grants, NM. Mine water recovery ceased in 1992 because of a decline in the price of uranium, but resumed in 1994. Approximately 78 tons of U_3O_8 were produced from mine water recovery.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN NEW MEXICO 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Clays, common		127	274	32	165	41	129
Copper 3/		250	764,000	256	614,000	W	W
Gemstones		NA	22	NA	54	NA	54
Potash		2,330	209,000	2,430	225,000	2,450	240,000
Pumice and pumicite	metric tons	W	W	102,000	527	W	W
Sand and gravel, construction		10,400	50,700	9,880	48,500	9,070	45,600
Silver 3/	metric tons	20	3,300	W	W	W	W
Stone, crushed		3,660	18,800	3,480 4/	18,800 4/	2,700 4/	15,000 4/
Combined value of cement (portland), clays (fire), gold, gypsum (crude), iron ore (usable), mica (crude), molybdenum, perlite (crude), salt, stone [crushed quartzite and traprock (1996-97), dimension granite and marble], zeolites, and values indicated symbol W		XX	83,900	XX	85,100	XX	693,000
Total		XX	1,130,000	XX	992,000	XX	994,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Recoverable content of ores, etc.

4/ Excludes certain stones; value included with "Combined value" data.

TABLE 2
NEW MEXICO: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone 2/	20	1,640	$6,180	$3.77	23	1,350	$6,090	$4.50
Granite	4	1,470	9,110	6.21	6	1,490	9,240	6.20
Volcanic cinder and scoria	5	197	1,770	8.98	5	283	2,170	7.66
Traprock	1	W	213	W	(3/)	(3/)	(3/)	(3/)
Quartzite	1	W	W	9.96 r/	(3/)	(3/)	(3/)	(3/)
Miscellaneous stone	2	W	W	4.53	3	348	1,350	3.87
Total	XX	3,660	18,800	5.12	XX	3,480	18,800	5.42

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes "limestone-dolomite" reported with no distinction between the two.

3/ Excludes quartzite and traprock from State total to avoid disclosing company proprietary data.

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TABLE 3
NEW MEXICO: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch), riprap and jetty stone	21	$179	$8.52
Coarse aggregate, graded:			
Concrete aggregate, coarse	275	1,530	5.57
Bituminous surface-treatment aggregate	57	284	4.98
Other graded coarse aggregate 3/	759	6,090	8.03
Fine aggregate (-3/8 inch):			
Stone sand, concrete	W	W	4.22
Screening, undesignated	278	611	2.20
Coarse and fine aggregates:			
Graded road base or subbase	178	673	3.78
Unpaved road surfacing	W	W	4.22
Terrazzo and exposed aggregate	112	1,590	14.16
Crusher run or fill or waste	30	145	4.83
Other construction materials 4/	36	208	5.78
Agricultural limestone	(5/)	(5/)	3.89
Chemical and metallurgical, cement manufacture	(5/)	(5/)	4.77
Unspecified: 6/			
Actual	285	1,100	3.86
Estimated	813	3,420	4.20
Total	3,480	18,800	5.42

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Includes granite, limestone, miscellaneous stone, and volcanic cinder and scoria; excludes quartzite and traprock from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown
3/ Includes bituminous aggregate (coarse) and railroad ballast.
4/ Includes roofing granules.
5/ Withheld to avoid disclosing company proprietary data; included in "Total."
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 4
NEW MEXICO: CRUSHED STONE SOLD OR USED BY PRODUCERS IN
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Construction aggregates:				
Coarse aggregate (+1 1/2 inch) 3/	19	159	2	20
Coarse aggregate, graded 4/	1,050	7,790	40	117
Fine aggregate (-3/8 inch) 5/	W	W	W	W
Coarse and fine aggregate 6/	W	W	W	W
Other construction materials 7/	518	2,750	115	477
Agricultural 8/	(9/)	(9/)	--	--
Chemical and metallurgical 10/	(9/)	(9/)	--	--
Unspecified 11/				
Actual	234	1,040	51	56
Estimated	434	1,660	379	1,750
Total	2,890	16,400	588	2,420

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Excludes quartzite and traprock from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes riprap and jetty stone.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), and screening (undesignated).
6/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, and crusher run (select material or fill).
7/ Includes roofing granules.
8/ Includes agricultural limestone.
9/ Withheld to avoid disclosing company proprietary data; included in "Total."
10/ Includes cement manufacture.
11/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 5
NEW MEXICO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products 2/	1,580	$9,450	$5.97
Asphaltic concrete aggregates and other bituminous mixtures	500	3,200	6.40
Road base and coverings	885	4,150	4.69
Fill	320	627	1.96
Other miscellaneous uses 3/	385	663	1.72
Unspecified: 4/			
Actual	3,820	19,200	5.01
Estimated	2,380	11,200	4.73
Total or average	9,880	48,500	4.91

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes railroad ballast, and snow and ice control.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 6
NEW MEXICO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	886	5,130	697	4,330
Asphaltic concrete aggregates and roadbase materials	982	5,950	402	1,400
Fill	123	218	198	409
Other miscellaneous uses 3/	7	38	378	625
Unspecified: 4/				
Actual	3,710	18,600	117	611
Estimated	1,800	8,650	579	2,600
Total	7,500	38,500	2,370	9,970

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes railroad ballast, and snow and ice control.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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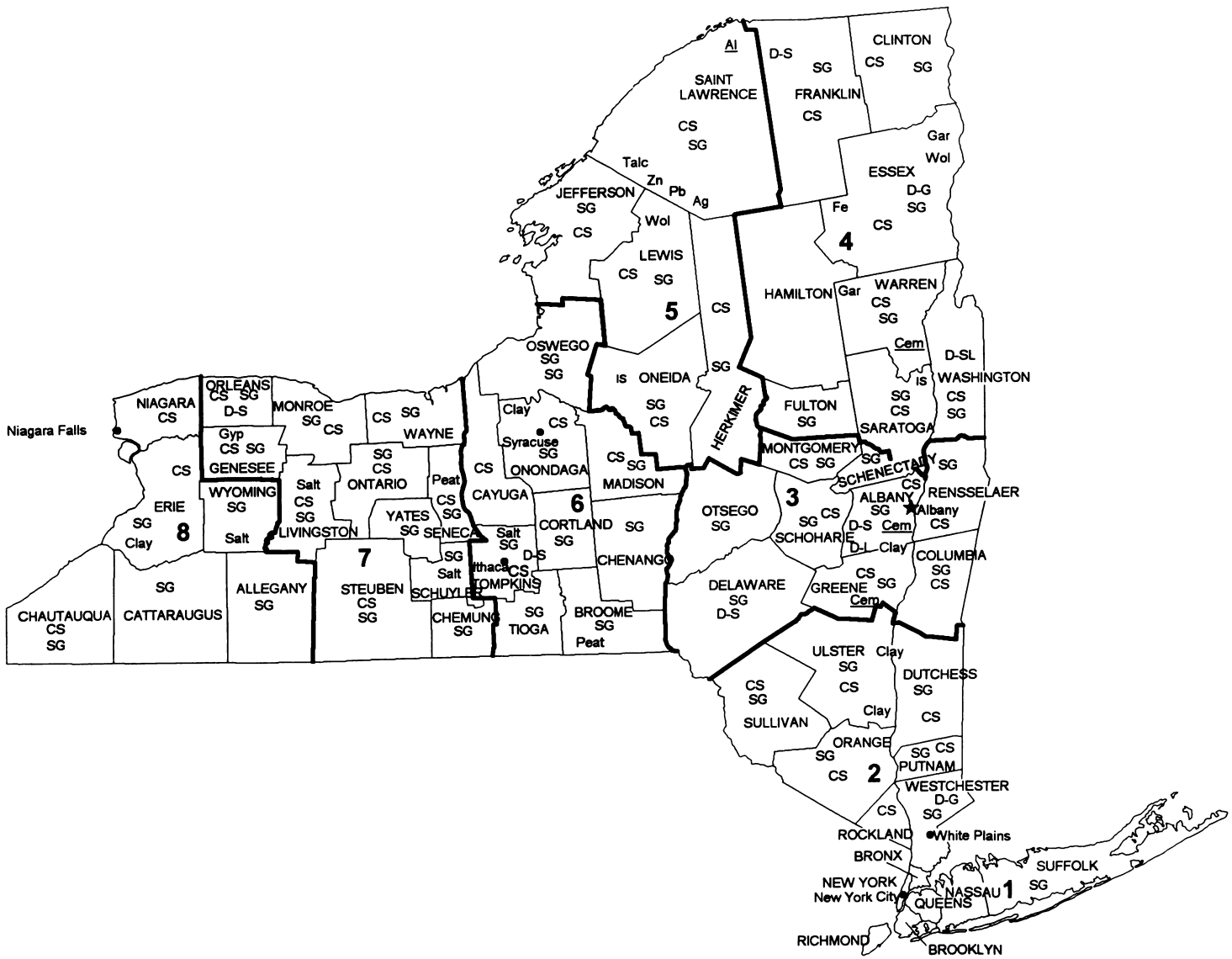
NEW YORK



LEGEND

- State boundary
- County boundary
- ★ Capital
- ● City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Ag	Silver
Al	Aluminum plant
Cem	Cement plant
Clay	Clay
CS	Crushed stone
D-G	Dimension granite
D-L	Dimension limestone
D-S	Dimension sandstone
D-SL	Dimension slate
Fe	Iron
Gar	Garnet
Gyp	Gypsum
IS	Industrial sand
Pb	Lead
Peat	Peat
Salt	Salt
SG	Sand and gravel
Talc	Talc minerals
Wol	Wollastonite
Zn	Zinc

0 50 Kilometers

Source: New York State Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF NEW YORK

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the New York State Geological Survey for collecting information on all nonfuel minerals.

In 1997, for the third consecutive year, New York ranked 16th in the Nation in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The State was 15th in 1996. The estimated value for 1997 was $904 million, about a 1.5% increase from that of 1996. This followed a marginal increase from 1995 to 1996 (based on final 1996 data). The State accounted for more than 2% of the U.S. total nonfuel mineral production value.

In 1997, crushed stone, by value, remained New York's leading nonfuel mineral, followed by portland cement, salt, construction sand and gravel, and zinc. About 88% of the State's nonfuel mineral production value came from industrial minerals. Primarily, these were, in descending order of value, crushed stone, portland cement, salt, construction sand and gravel, and wollastonite. Zinc accounted for the major portion of metal production and value. Although the State's increases in nonfuel mineral values in 1996 and 1997 were small, there were significant changes in individual commodities. The $49-million combined increase of crushed stone and construction sand and gravel values plus a significant increase in zinc and a smaller increase in portland cement more than balanced the substantial decrease in the value of salt *(table 1)* combined with smaller decreases in crude gypsum, industrial garnet, and industrial sand and gravel. Other nonfuel minerals that increased in value included wollastonite, lead, dimension stone, gemstones, and peat. Other nonfuel minerals that decreased in value were silver and talc. Common clays and masonry cement remained the same.

From 1995 to 1996, New York's small net increase in nonfuel mineral production value mainly resulted from similarly large changes in individual commodities. In 1996, substantial increases in the values of crushed stone, salt, and construction sand and gravel more than offset decreases in the values of portland cement *(table 1)* and zinc. The majority of other nonfuel minerals increased in value, but all other increases and decreases in 1996 were small relative to those above.

Based on USGS estimates of the quantities produced in the 50 States in 1997, New York remained the only State to produce wollastonite, and third in the production of zinc, fourth in salt and talc, sixth in lead, and ninth in portland cement. The State dropped to second from first of two industrial garnet-producing States. Additionally, New York mining and mineral processing operations produced significant quantities of crushed stone, construction sand and gravel, common clays, dimension stone, and masonry cement.

The following narrative information was provided by the New York State Geological Survey[2] (NYSGS). The New York State Department of Environmental Conservation issued a total of 439 Mined Land Reclamation permits in 1997. Of the total, 355 were renewal permits and 84 were new. Additionally, 84 mine sites received final reclamation approval. At the end of 1997, 2,474 mines, 1,801 industry-owned and 673 government-owned, were active in the State. The number of hectares under permit at the end of 1997 were 38,300 with 18,135 currently affected by mining. A total of 264 hectares were reclaimed in 1997 for a total of 6,258 that have been reclaimed since 1974.

A group of western New York business persons agreed to purchase the developmental rights to the Hampton Corners salt mine project from Akzo Nobel Salt Inc. The agreement includes the purchase of approximately 3,600 hectares of Akzo Nobel property, mineral rights and mineral rights options, certain mining equipment, and all State and local approvals and permits granted thus far to construct the mine at the Akzo Nobel Hampton Corners, Livingston County site. The goal of the new company, which will be known as American Rock Salt Inc., is to break ground in the spring of 1998. The new mine, when operating at full production, is projected to employ between 150 and 200 employees with approximately 75% of those being hourly employees directly involved in mining related activities. Activities in 1997 centered on clearing the legal challenges filed by anti-mining groups regarding State issuance of the mining permit for the Hamptons Corners site.

Legislation establishing explicit authority for the New York State Department of Environmental Conservation to regulate underground mining operations has been submitted for consideration to the legislature. The proposed legislation is similar to that which was introduced by the State Governor in 1996 but died in committee.

In other mining news, the 1997 Annual Meeting of the Interstate Mining Compact Commission was held in Lake Placid, NY, in September. Tracy Materials, Inc. was named winner of the 1997

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys – mineral commodity, State, and country – also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]William Kelly, Associate Scientist with the New York State Geological Survey, authored the text of mineral industry information submitted by that agency.

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New York State Department of Conservation Reclamation Award. This same company received Honorable Mention in the national Interstate Mining Compact Commission Non-coal Reclamation Awards category.

The NYSGS released several open file reports and completed a seven-year investigation into the aggregate and heavy mineral resources, mineral chemistry, and geologic framework of the continental shelf south of Long Island. These studies were conducted cooperatively with the U.S. Department of the Interior's Minerals Management Service, the USGS, the University of the State of New York, Stony Brook, and the City University of New York, Queens College.

The NYSGS has made available a digital version of the 1:250,000 surficial geologic map of the State. This is a materials-based map illustrating the location of sand and gravel, clay, and other mineral resources in addition to till and outcrops; as such, it is of interest to the mineral industry. The map can be transferred to a user via FTP and at no cost. Access to the data is at http://www.nysm.nysed.gov/datasets.html. The corollary bedrock map is available at the same location.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN NEW YORK 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Cement:						
Masonry	90	7,210	W	W	W	W
Portland	2,530	205,000	2,570	157,000 e/	2,620	163,000 e/
Clays, common	563	12,500	652	14,000	648	14,000
Gemstones	NA	W	NA	291	NA	337
Salt	4,480	185,000	4,420	203,000	3,610	158,000
Sand and gravel, construction	27,300	134,000	28,100	145,000	29,500	156,000
Stone:						
Crushed	39,500	204,000	43,600	233,000	47,000	271,000
Dimension metric tons	32,800	8,440	34,400	8,120	34,600	8,160
Combined value of garnet (industrial), gypsum (crude), lead, peat, sand and gravel (industrial), silver, talc and pyrophyllite, wollastonite, zinc, and values indicated by symbol W	XX	130,000	XX	130,000	XX	133,000
Total	XX	886,000	XX	891,000	XX	904,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
NEW YORK: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone 2/	63	27,000	$134,000	$4.95	84	27,600	$136,000	$4.93
Dolomite	12	6,310	41,700	6.61	11	7,880	50,900	6.46
Granite	12	4,230	13,100	3.09	11	3,560	19,200	5.40
Traprock	2	W	W	8.08	2	W	W	7.92
Sandstone	6	752	4,160	5.54	7	1,740	8,830	5.08
Marble	1	98	1,850	18.90	1	80	1,380	17.20
Slate	1	W	W	6.18	1	W	W	4.27
Miscellaneous	--	--	--	--	5	5,990	6,900	1.15
Total	XX	39,500	204,000	5.15	XX	43,600	233,000	5.34

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits, except unit values; may not add to totals shown.
2/ Includes "limestone-dolomite," reported with no distinction between the two.

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TABLE 3
NEW YORK: CRUSHED STONE SOLD OR USED
BY PRODUCERS IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	277	$3,220	$11.64
Riprap and jetty stone	614	3,920	6.38
Filter stone	188	1,130	5.98
Other coarse aggregate	206	1,660	8.07
Coarse aggregate, graded:			
Concrete aggregate, coarse	2,120	15,400	7.29
Bituminous aggregate, coarse	4,590	32,400	7.05
Bituminous surface-treatment aggregate	1,100	6,650	6.03
Railroad ballast	48	280	5.83
Other graded coarse aggregate	1,300	11,300	8.70
Fine aggregate (-3/8 inch):			
Stone sand, concrete	328	1,650	5.04
Stone sand, bituminous mix or seal	1,170	8,410	7.20
Screening, undesignated	618	3,260	5.28
Coarse and fine aggregates:			
Graded road base or subbase	4,850	29,400	6.07
Unpaved road surfacing	247	1,350	5.46
Crusher run or fill or waste	2,730	15,500	5.70
Other coarse and fine aggregates	1,140	5,520	4.86
Other construction materials 3/	748	5,140	6.87
Agricultural:			
Agricultural limestone	80	705	8.81
Other agricultrual uses	4	42	10.50
Chemical and metallurgical:			
Cement manufacture	3,810	15,000	3.95
Lime manufacture	46	1,020	22.24
Special:			
Other fillers or extenders	2	113	56.50
Other specified uses not listed	250	1,680	6.71
Unspecified: 4/			
Actual	9,900	41,000	4.14
Estimated	7,290	27,300	3.75
Total	43,600	233,000	5.34

1/ Includes dolomite, granite, limestone, limestone-dolomite, marble, sandstone, slate, traprock, and miscellaneous stone.
2/ Data are rounded to three significant digits, except for unit values; may not add to totals shown.
3/ Includes drain fields, terrazzo and exposed aggregate, and other fine aggregate.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
NEW YORK: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE AND DISTRICT 1/ 2/ 3/

(Thousand metric tons and thousand dollars)

Use	District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 4/	292	2,810	W	W	W	W
Coarse aggregate, graded 5/	4,330	37,500	1,470	10,700	856	5,190
Fine aggregate (-3/8 inch) 6/	999	8,420	W	W	W	W
Coarse and fine aggregate 7/	1,190	10,300	W	W	984	5,810
Other construction materials 8/	--	--	781	5,460	309	1,950
Agricultural 9/	(10/)	(10/)	(10/)	(10/)	(10/)	(10/)
Chemical and metallurgical 11/	--	--	(10/)	(10/)	(10/)	(10/)
Special 12/	--	--	--	--	--	--
Unspecified: 13/						
Actual	(10/)	(10/)	935	5,030	--	--
Estimated	3,120	11,900	789	3,290	23	99
Total	10,400	73,300	8,360	45,300	2,810	14,900

Use	District 6		District 7		District 8	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 4/	156	1,770	375	1,880	W	W
Coarse aggregate, graded 5/	1,130	6,200	W	W	W	W
Fine aggregate (-3/8 inch) 6/	542	2,820	W	W	W	W
Coarse and fine aggregate 7/	1,530	7,510	W	W	W	W
Other construction materials 8/	9	55	2,870	15,500	3,490	16,500
Agricultural 9/	(10/)	(10/)	(10/)	(10/)	(10/)	(10/)
Chemical and metallurgical 11/	(10/)	(10/)	--	--	--	--
Special 12/	(10/)	(10/)	--	--	--	--
Unspecified: 13/						
Actual	3,960	14,500	(10/)	(10/)	(10/)	(10/)
Estimated	1,480	6,010	1 780	5,890	100	151
Total	8,880	40,200	7,950	36,800	5,270	22,700

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ No crushed stone was produced in District 1.
2/ Production reported in District 5 was included with "District 6" to avoid disclosing company proprietary data.
3/ Data are rounded to three significant digits; may not add to totals shown.
4/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
5/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad and other graded coarse aggregate.
6/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
7/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select or fill), and other coarse and fine aggregates.
8/ Includes drain fields.
9/ Includes agricultural limestone and other agricultural uses.
10/ Withheld to avoid disclosing company proprietary data; included in "Total."
11/ Includes cement and lime manufacture.
12/ Includes other fillers or extenders and other specified uses not listed.
13/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
NEW YORK: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	5,410	$32,400	$5.98
Plaster and gunite sands	183	1,050	5.73
Concrete products (blocks, bricks, pipe, decorative, etc.)	164	1,410	8.60
Asphaltic concrete aggregates and other bituminous	2,500	14,000	5.59
Road base and coverings 2/	5,440	24,200	4.44
Fill	1,870	5,030	2.69
Snow and ice control	1,440	5,560	3.87
Other miscellaneous uses 3/	1,450	5,660	3.92
Unspecified: 4/			
Actual	2,340	11,600	4.98
Estimated	7,320	44,600	6.09
Total or average	28,100	145,000	5.17

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes filtration, railroad ballast, and roofing granules.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
NEW YORK: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	1,890	11,200	658	4,880	786	3,560	232	975
Asphaltic concrete aggregates and roadbase materials 3/	224	1,970	915	4,600	2,090	8,270	668	2,000
Snow and ice control	36	156	116	670	240	1,010	288	974
Other miscellaneous uses 4/	12	150	24	191	6	11	12	50
Unspecified: 5/								
Actual	440	3,130	5	23	57	285	--	--
Estimated	1,670	18,000	890	3,850	320	1,370	748	2,530
Total	4,280	34,600	2,610	14,200	3,500	14,500	1,950	6,530

	District 5		District 6		District 7		District 8	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	85	440	927	6,340	1,040	6,540	144	903
Asphaltic concrete aggregates and roadbase materials 3/	480	1,400	2,960	13,300	1,120	4,620	1,360	7,050
Snow and ice control	76	186	376	1,260	204	935	103	369
Other miscellaneous uses 4/	12	42	207	775	224	839	947	3,610
Unspecified: 5/								
Actual	212	1,040	26	89	--	--	1,600	7,070
Estimated	449	1,970	735	3,990	1,440	7,290	1,070	5,600
Total	1,310	5,070	5,230	25,700	4,030	20,200	5,220	24,600

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill and road and other stabilization (cement and lime).
4/ Includes filtration, railroad ballast, and roofing granules.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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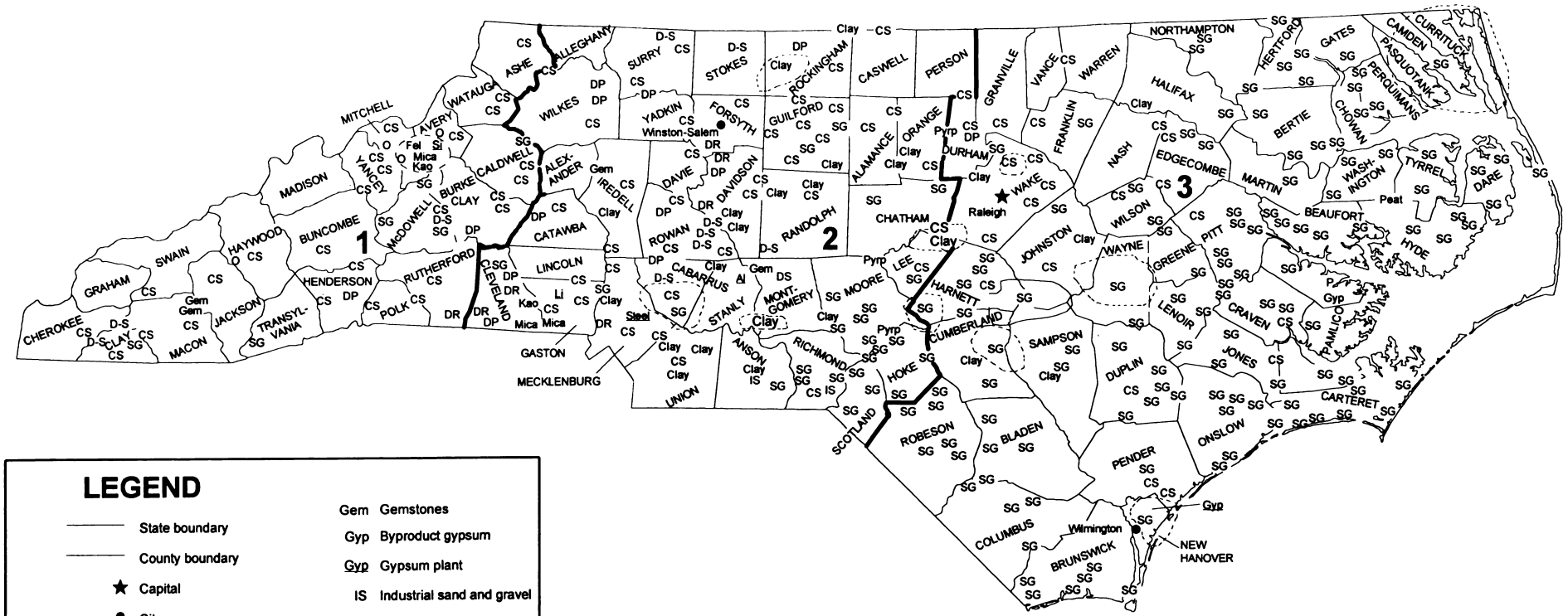
NORTH CAROLINA



LEGEND

- State boundary
- County boundary
- ★ Capital
- ● City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Al	Aluminum plant
Clay	Clay
CS	Crushed stone
DR/DP	Dredged/dipped sand and other surficial materials
D-S	Dimension stone
Fel	Feldspar
Gem	Gemstones
Gyp	Byproduct gypsum
Gyp	Gypsum plant
IS	Industrial sand and gravel
Kao	Kaolin
Li	Lithium mine and plant
Mica	Mica
O	Olivine
P	Phosphate rock
Peat	Peat
Pyrp	Pyrophyllite
SG	Sand and gravel
Si	Silica plant
Steel	Iron and steel plant
	Concentration of mineral operations

0 — 50 Kilometers

Source: North Carolina Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF NORTH CAROLINA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the North Carolina Geological Survey for collecting information on all nonfuel minerals.

In 1997, North Carolina ranked 20th nationally in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The State was 18th in 1996. The estimated value for 1997 was $758 million, a nearly 10% increase from that of 1996. This followed a 6.1% decrease from 1995 to 1996 (based on final 1996 data). The State accounted for almost 2% of the U.S. total nonfuel mineral production value.

In 1997, the increased values of crushed stone, construction sand and gravel, and common clays (*table 1*) combined to more than offset a substantial decrease in the production value of lithium minerals. Smaller increases in the values of phosphate rock and industrial sand and gravel also made significant contributions to the State's net increase in nonfuel mineral production value for the year. All other commodities increased in value in 1997 except for gemstones, olivine, and peat, which showed small decreases. In 1996, decreases in the values of phosphate rock, lithium minerals, and gemstones accounted for most of the year's drop in value. Only crushed stone showed a significant gain in value.

Based on 1997 USGS estimates of the quantities of minerals produced in the 50 States, North Carolina continued as the leading State in feldspar and crude mica production; first of two States that produced lithium minerals and olivine; third of four States that produce phosphate rock; fifth in talc and pyrophyllite; and sixth in kaolin. North Carolina remained 10th in dimension stone; rose to 8th from 10th in crushed stone; and dropped from 1st to 2nd in the production of common clays. North Carolina mines have produced exclusively industrial minerals since the early 1970's, particularly since the 1971 closing of the Tungsten Queen Mine, an underground tungsten mine in Vance County. Metal production in the State, especially that of primary aluminum, results from the processing of recycled materials or raw materials received from other domestic and foreign sources.

The following narrative information was provided by the North Carolina Geological Survey[2] and was based on publicly available 10-K and company annual reports. Zemex is a niche producer of industrial minerals and metal products. Its major products include aluminum dross derivatives, feldspar, ferrous and nonferrous powders, kaolin, mica, sand, and talc. The industrial minerals segment consists of five wholly-owned subsidiaries as follows: The Feldspar Corp., Suzorite Mica Products Inc., Suzorite Mineral Products, Inc., Zemex Industrial Minerals, Inc. and Zemex Mica Corp. The group is collectively referred to as Zemex Industrial Minerals.

During 1997, considerable efforts by Zemex were directed to product development, marketing, capital expansion projects, and product quality improvement. Capital expenditures for Zemex were $9.9 million in 1997 compared with $11.9 million in 1996 and $9.7 million in 1995. Major capital spending in 1997 included the completion of the sodium feldspar facility and the low-iron sand plant at Spruce Pine, NC.

Potash Corp. of Saskatchewan (PCS) mines phosphate ore and manufactures animal feed supplements, purified phosphoric acid (used in food products and industrial processes), and solid and liquid fertilizers. PCS conducts its phosphate operations primarily at two facilities, one near Aurora, NC, and the other near White Springs in northern Florida. PCS believes the Aurora facility to be the largest integrated phosphate mine and phosphate processing complex at one site in the world. The Aurora facility includes a 6-million-metric-ton-per-year mining operation, four sulfuric acid plants, four phosphoric acid plants, a liquid fertilizer plant, a superphosphoric acid plant, two diammonium phosphate (DAP) plants, and a solid fertilizer plant capable of producing DAP, granular triple superphosphate or monoammonium phosphate. PCS produces high purity phosphoric acid at Aurora in a joint venture with Albright and Wilson Americas.

According to PCS, the annual production capacity of the company's mines is currently 9.6 million tons of phosphate rock. During 1997, the Aurora facility's total production of phosphate rock was 4.8 million tons. The company generally operates its phosphate mine and phosphate processing plants 24 hours a day, 7 days a week, using rotating shifts.

Phosphate rock is the major input in the company's phosphorus processing operations. In addition to phosphate ore, the principal raw materials required by the company are sulfur, sulfuric acid, and ammonia.

The production of phosphoric acid requires substantial quantities of sulfur which PCS purchases from third parties. In December 1997, PCS entered into a 10-year supply contract with an offshore supplier to supply a portion of its sulfur requirements.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Jeffrey Reid, Chief Geologist, Division of Land Resources, authored the text of mineral industry information provided by the North Carolina Geological Survey.

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Aurora facility as needed.

Substantially all of the phosphate rock produced by the company is used internally for the production of phosphoric acid, superphosphoric acid, chemical fertilizers, purified phosphoric acid, and animal feed products.

According to PCS, its Aurora phosphate mine had estimated proven and probable reserves of approximately 393 million tons of phosphate rock at an average grade of 30.7% P_2O_5. These reserves would permit mining to continue at current rates for about 75 years. The Aurora phosphate mine has an estimated annual capacity of 6.0 million tons of phosphate rock and its processing plants have the capacity to produce 1.152 million tons of phosphoric acid (as P_2O_5).

PCS receives ammonia for its phosphate operations at Aurora through its ammonia terminal in Savannah, GA. The ammonia is shipped by rail from Savannah to the Aurora facility.

A significant portion of the PCS phosphate reserves in Aurora is located in wetlands. Under the U.S. Federal Clean Water Act, a permit must be obtained from the U.S. Army Corps of Engineers (the Corps) before mining activity that will disturb the wetlands may occur. PCS requested that an alternative that would disturb the least amount of wetlands be approved by the Corps and that a permit be issued. In 1997, PCS received its required authorizations from the State of North Carolina and on August 14, 1997, the Corps issued a permit granting approval through 2017 to mine certain areas described in a Environmental Impact Statement. The permit contains a section on wetlands mitigation approach and methods regarding wetland impacts associated with mining covered by the permit. PCS has recently acquired additional land adjacent to its Aurora facilities for this purpose. In order to demonstrate the feasibility of such activities, as of December 31, 1997, PCS had created or restored 979 hectares of wetlands.

In addition to the wetlands permit from the Corps, the PCS also needs additional authorizations from North Carolina to continue its mining activities. PCS is required to have State mining permits that contain bonding and reclamation requirements. PCS has a State mining permit for the areas presently being mined by the company that is effective through 2003, but this permit must be amended periodically to add additional areas during this period. PCS also holds another mining permit from the State for the area of the property that contains the wetlands covered by the permit issued by the Corps. This State permit has been renewed until 2005.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN NORTH CAROLINA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995		1996		1997 p/	
		Quantity	Value	Quantity	Value	Quantity	Value
Clays, common		2,430	12,500	2,400	12,400	2,550	23,700
Feldspar	metric tons	497,000	18,400	481,000	18,400	481,000	19,000
Gemstones		NA	4,440	NA	693	NA	581
Mica, crude		74	3,690	62	4,900	56	5,050
Peat		19	340	15	311	11	225
Sand and gravel:							
Construction		10,100	50,100	10,000	50,500	12,800	66,000
Industrial		1,330	21,900	1,500	21,700	1,550	23,600
Stone:							
Crushed		57,300	384,000	57,200	394,000	66,000	460,000
Dimension	metric tons	41,100 3/	15,400 3/	37,300	14,300	37,500	14,300
Combined value of clays (kaolin), lithium minerals, olivine, phosphate rock, stone [dimension quartzite, sandstone, slate and miscellaneous (1995)], and talc and pyrophyllite		XX	225,000	XX	172,000	XX	144,000
Total		XX	735,000	XX	690,000	XX	756,000

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; value included with "Combined value" data.

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TABLE 2
NORTH CAROLINA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone	12	5,680	$38,800	$6.83	11	6,250	$43,200	$6.91
Dolomite	1	265	1,820	6.86	1	251	1,720	6.85
Calcareous marl	3	135	942	6.98	3	131	917	7.00
Granite	72 r/	43,600 r/	288,000 r/	6.62	71	42,400	289,000	6.83
Traprock	7	4,540	30,600	6.74	7	4,500	31,300	6.94
Slate	2	W	W	7.39	3	W	W	7.35
Volcanic cinder and scoria	1	W	W	7.21	1	W	W	7.39
Quartzite	2	W	W	6.70	2	W	W	7.09
Miscellaneous stone	1 r/	W	W	8.00 r/	1	W	W	8.20
Total	XX	57,300	384,000	6.69	XX	57,200	394,000	6.89

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 3
NORTH CAROLINA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	20	$138	$6.90
Riprap and jetty stone	618	5,210	8.43
Filter stone	297	2,060	6.92
Other coarse aggregate	48	361	7.52
Coarse aggregate, graded:			
Concrete aggregate, coarse	3,290	24,300	7.38
Bituminous aggregate, coarse	1,770	14,400	8.15
Bituminous surface-treatment aggregate	1,240	9,200	7.40
Railroad ballast	1,440	7,400	5.14
Other graded coarse aggregate	W	W	8.85
Fine aggregate (-3/8 inch):			
Stone sand, concrete	403	2,010	4.98
Stone sand, bituminous mix or seal	743	4,220	5.68
Screening, undesignated	1,270	7,930	6.24
Other fine aggregate	W	W	6.31
Coarse and fine aggregates:			
Graded road base or subbase	8,200	48,500	5.92
Unpaved road surfacing	581	3,680	6.34
Terrazzo and exposed aggregate	W	W	12.95
Crusher run or fill or waste	973	5,650	5.80
Other coarse and fine aggregates	W	W	5.43
Other construction materials 3/	3,740	26,400	7.06
Agricultural:			
Agricultural limestone	(4/)	(4/)	5.56
Poultry grit and mineral food	(4/)	(4/)	4.00
Other agricultural uses	(4/)	(4/)	6.00
Special:			
Mine dusting or acid water treatment	(4/)	(4/)	8.85
Other specified uses not listed	(4/)	(4/)	6.61
Unspecified: 5/			
Actual	31,200	223,000	7.16
Estimated	1,270	8,190	6.45
Total	57,200	394,000	6.89

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Includes calcareous marl, dolomite, granite, limestone, miscellaneous stone, quartzite, slate, traprock, and volcanic cinder and scoria.
2/ Data are rounded to three significant digits except unit value; may not add to totals shown.
3/ Includes lightweight aggregate (slate).
4/ Withheld to avoid disclosing company proprietary data; included in "Total."
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
NORTH CAROLINA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	303	2,390	(3/)	(3/)	(3/)	(3/)
Coarse aggregate, graded 4/	2,950	20,300	W	W	W	W
Fine aggregate (-3/8 inch) 5/	892	5,960	W	W	W	W
Coarse and fine aggregate 6/	3,970	25,100	W	W	W	W
Other construction materials 7/	48	324	12,100	81,000	3,680	21,500
Agricultural 8/	(3/)	(3/)	(3/)	(3/)	(3/)	(3/)
Special 9/	(3/)	(3/)	--	--	--	--
Unspecified 10/						
Actual	48	337	18,100	128,000	13,000	94,700
Estimated	385	2,290	62	379	822	5,530
Total	8,730	57,600	30,700	213,000	17,800	123,000

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Withheld to avoid disclosing company proprietary data; included in "Total."
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (selectmaterial or fill), and other coarse and fine aggregates.
7/ Includes lightweight aggregate (slate).
8/ Includes agricultural limestone, poultry grit and mineral food, and other agricultural use.
9/ Includes mine dusting or acid water treatment and other specified uses not listed.
10/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
NORTH CAROLINA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	3,280	$13,600	$4.15
Plaster and gunite sands	15	82	5.47
Concrete products (blocks, bricks, pipe, decorative, etc.)	669	2,040	3.05
Asphaltic concrete aggregates and other bituminous mixtures	669	2,380	3.56
Road base and coverings 2/	658	3,600	5.47
Fill	1,550	7,020	4.53
Snow and ice control	19	92	4.84
Other miscellaneous uses 3/	837	10,700	12.76
Unspecified: 4/			
Actual	1,680	8,820	5.25
Estimated	665	2,220	3.33
Total or average	10,000	50,500	5.03

1/ Data are rounded to three significant digits except value per ton; may not add to totals shown.
2/ Includes road and other stabilization (lime).
3/ Includes filtration and railroad ballast.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
NORTH CAROLINA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	352	2,770	1,170	4,270	2,440	8,690
Asphaltic concrete aggregate and road base materials 3/	602	3,620	957	6,100	1,340	3,370
Other miscellaneous uses 4/	143	984	657	9,600	37	107
Unspecified: 5/						
Actual	--	--	613	2,950	1,070	5,880
Estimated	54	118	216	808	395	1,290
Total	1,150	7,490	3,610	23,700	5,280	19,300

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill, road and other stabilization (lime), and snow and ice control.
4/ Includes filtration and railroad ballast.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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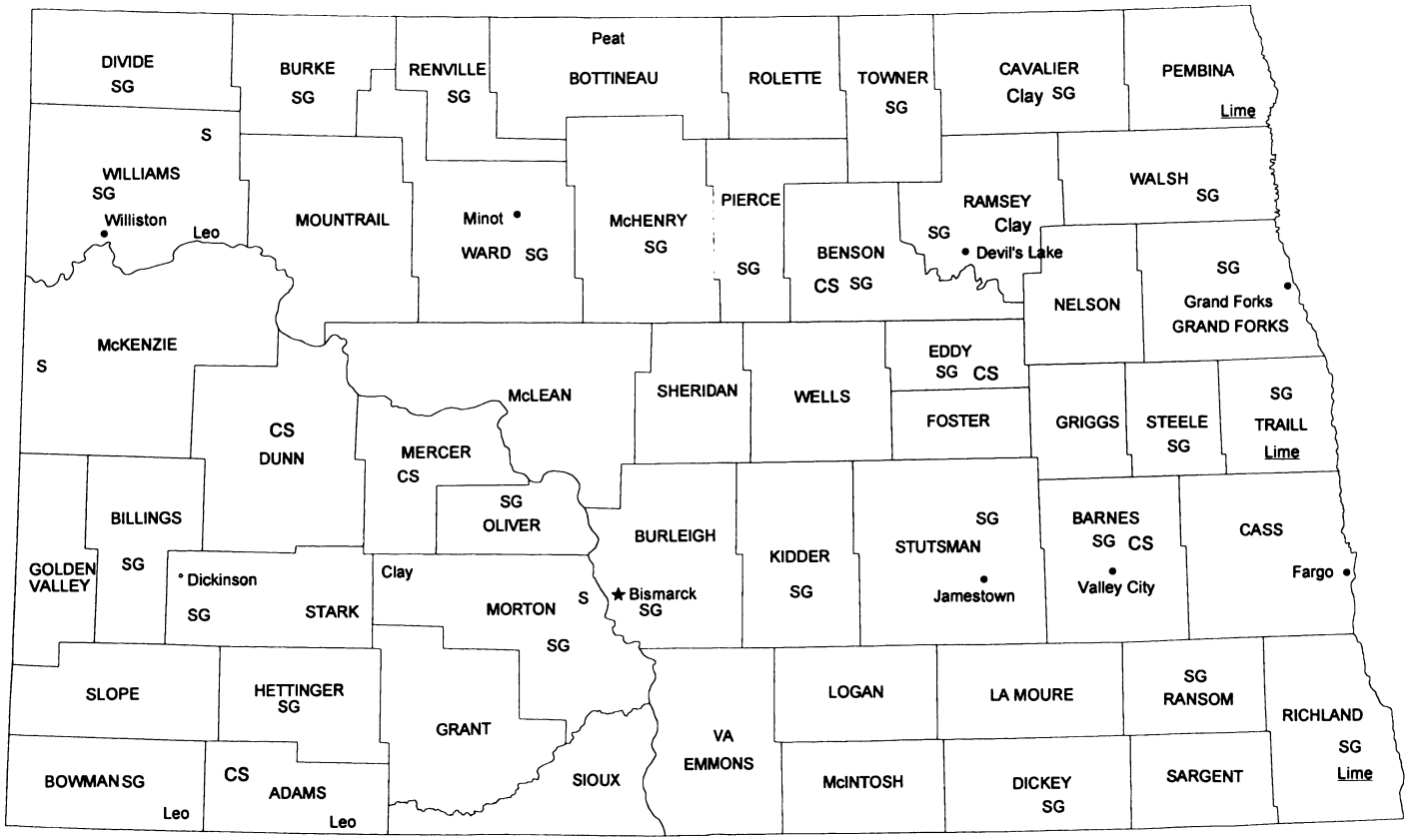
NORTH DAKOTA



LEGEND

- State boundary
- County boundary
- ★ Capital
- • City

MINERAL SYMBOLS

Clay	Clay
CS	Crushed stone
Leo	Leonardite
Lime	Lime plant
Peat	Peat
S	Sulfur
SG	Sand and gravel
VA	Volcanic ash

0 50 Kilometers

Source: North Dakota Geological Survey/U.S. Geolgical Survey

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THE MINERAL INDUSTRY OF NORTH DAKOTA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the North Dakota Geological Survey for collecting information on all nonfuel minerals.

In 1997, for the third consecutive year, North Dakota ranked 48th in the Nation in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $31.6 million, a 2.6% increase from that of 1996. This followed a marginal decrease of a little more than 1% from 1995 to 1996 (based on final 1996 data). The State accounted for about one-tenth of 1% of the U.S. total nonfuel mineral production value.

North Dakota's leading nonfuel mineral by value was construction sand and gravel. This high-volume, low-value commodity accounted for 77% of the State's nonfuel mineral production value. In 1997, except for a slight increase in the values of construction and industrial sand and gravel, all mineral commodity values remained virtually the same. In 1996, the magnitudes of change were similar with slight decreases occurring in construction and industrial sand and gravel and lime.

The following narrative information was provided by the North Dakota Geological Survey[2] (NDGS). During 1997, 18 surface mining operations were operational, as reported to the State Soil Conservation Service. Based on these reports, 117 hectares were affected. The quantity of minerals mined included 1,480,000 cubic meters of sand and gravel, 60,800 cubic meters of clay, and 77,600 cubic meters of crushed stone, totaling 1,620,000 cubic meters of mineral material. From 51 pits ranging in size for 0.3 to 24 hectares, a total of 252,000 cubic meters of overburden were disturbed. Hebron Brick Co. in Morton County continued to lead the State in clay products production, and accounted for 57% of the clay mined in the State.

In the fall of 1997, American Colloidal Co. submitted a permit to conduct surface mining operations for leonardite in Bowman County. Leonardite, associated with lignite, is an oxidized lignite. It is processed and used as a dispersant and for viscosity control in oilwell drilling muds, as a stabilizer for ion-exchange resins in water treatment, and as a soil conditioner. Currently, GeoResources, Inc. of Williston, Williams County, is the only leonardite mining and processing operation in North Dakota besides American Colloidal. The two companies produced a combined total of 59,500 metric tons of leonardite in 1997. American Colloidal anticipates 36,000 to 72,500 metric tons of leonardite per year to be processed, depending on market demands. The company hopes to begin production at the new site in the summer of 1998. The life of the mine is expected to be 6 years.

During the 1997 legislative session, two bills passed that directly affect the nonfuel minerals industry. The State Soil Conservation Committee (SSCC) was designated by the Legislature to administer the Surface Mining Reports Law (SMRL). The SMRL requires the reporting of all activities by any person conducting surface mining operations for minerals other than coal, who, within one calendar year, removes 7,650 cubic meters (10,000 cubic yards) or more of earthen materials or products, including overburden, affecting 0.2 hectare (0.5 acre) or more in combined mining operations. Detailed reporting requirements are described in North Dakota Century Code (NDCC) Chapter 38-16. At the same time, funding for the SSCC was cut by 75%, staff decreased to essentially one person, and some of their duties assigned to other State agencies. Mineral commodities included are cement rock, clay, gravel, limestone, manganese, molybdenum, peat, potash, pumicite, salt, sand, scoria, stone, sodium sulfate, zeolite, or other minerals, excluding coal. The SSCC has the regulatory authority to administer the reporting requirement, while actual regulatory authority for most of these mining activities rests with the NDGS. According to the NGDS, the law as written is somewhat ambiguous at best.

Also passed during the 1997 legislative session was an amendment clarifying the definition of "subsurface minerals." The definition of subsurface minerals as it now appears in the NDCC Chapter 38-12, Regulation, Development, and Production of Subsurface Minerals, and in NDCC Chapter 38-15, Resolution of Conflicts in Subsurface Mineral Production is as follows: "Subsurface minerals means all naturally occurring elements and their compounds, volcanic ash, precious metals, carbonates, and natural mineral salts of boron, bromine, calcium, chlorine, helium, iodine, lithium, magnesium, nitrogen, phosphorous, potassium, sodium, thorium, uranium, and sulfur, and their compounds, but does not include sand and gravel and rock crushed for sand and gravel" (NDCC Ch. 38-12-01.07). The definition still uses very broad language, but the addition of specific minerals and elements limits some of the confusion regarding the inclusion of sand and gravel in the subsurface mineral law. Sand and gravel mining activities are subject to the requirement mentioned in the previous paragraph (NDCC Ch. 38-16, SMRL).

The summary of surface mining statistics presented here by the

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. Construction sand and gravel estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/ minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Ann Fritz, Geologist, authored the text of State mineral industry information submitted by the North Dakota Geological Survey.

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NDGS in cooperation with the SSCC is a good faith, yet conservative, estimate of the amount of nonfuel minerals mined in North Dakota during 1997. Although mining operators of the minimum size and above were still required to submit reports, smaller operations needed to be estimated by the SSCC staff. Helpful in this effort were some operators who voluntarily submitted reports to the SSCC, even though they are not required by law to report a summary of surface mining activities.

The coal gasification plant located near Beulah brought its anhydrous ammonia plant fully on-line in the spring of 1997. The plant has the capacity to produce 1,040 tons of anhydrous ammonia per day, but currently is producing 952 tons because of nitric oxide emission limits. Total production of anhydrous ammonia in 1997 was about 188,000 tons. In 1997, the gasification plant also produced 3,620,000 liters of krypton and xenon, 2,070,000 liters of liquid nitrogen, and about nearly 745,000 liters of methanol. Ammonium sulfate production from the stack gas scrubber was 90,900 tons in 1997. Production of ammonium sulfate will be limited in 1998 because of the use of low-sulfur coal.

The NDGS continued the process of entering all of the geologic information from its subsurface mineral program into a computerized spreadsheet. This information will be used for a number of purposes, including redefining the State's uranium deposits.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN NORTH DAKOTA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays, common	59	W	59	W	59	W
Gemstones	NA	W	NA	3	NA	3
Sand and gravel, construction	8,420	23,900	8,320	23,800	8,320	24,400
Combined value of lime, peat, sand and gravel (industrial), and values indicated by symbol W	XX	7,300	XX	7,060	XX	7,160
Total	XX	31,200	XX	30,800	XX	31,600

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
NORTH DAKOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996, BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products	58	$403	$6.95
Asphaltic concrete aggregates and other bituminous mixtures	203	477	2.35
Road base and coverings 2/	2,140	4,990	2.33
Fill	103	206	2.00
Other miscellaneous uses 3/	27	99	3.67
Unspecified: 4/			
Actual	1	3	3.00
Estimated	5,780	17,600	3.04
Total or average	8,320	23,800	2.86

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes railroad ballast and snow and ice control.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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OHIO

LEGEND

- State boundary
- County boundary
- ★ Capital
- • City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Al	Aluminum plant	D-S	Dimension sandstone	Lime	Lime plant
CC-Sh	Common clay and shale	FC	Fire clay	Peat	Peat
Cem	Cement plant	Gyp	Gypsum	Salt	Salt
CS	Crushed stone	IS	Industrial sand	SG	Sand and gravel
D-L	Dimension limestone	( )	Concentration of mineral operations	Steel	Iron and steel plant

Source: Ohio Division of Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF OHIO

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Ohio Division of Geological Survey for collecting information on all nonfuel minerals.

In 1997, for the third consecutive year, Ohio ranked 14th in the Nation in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $984 million, up from $969 million in 1996. This followed an increase of nearly 8.8% from 1995 to 1996 (based on final 1996 data). The State accounted for 2.5% of the U.S. total nonfuel mineral production value.

In 1997, a decrease in the value of salt was more than balanced by the increase in the value of crushed stone (*table 1*). The remainder of Ohio's increase in nonfuel mineral value was mostly attributable to increases in construction sand and gravel, portland cement, and common clays, in descending order of relative increase. During 1996, nearly all nonfuel mineral commodities increased in value, led by significant increases in salt, crushed stone, and construction sand and gravel. Only lime showed a somewhat significant drop in value for the year.

Compared with USGS estimates of the quantities produced in the other 49 States during 1997, Ohio remained second in fire clays, third in salt, one of the top three lime-producing States, fourth in construction sand and gravel and common clays, and ninth in industrial sand and gravel. The State climbed to sixth from seventh in the production of crushed stone and was a significant producer of masonry cement.

The State's mines exclusively produce industrial minerals and coal; metals, such as steel and aluminum produced in the State are processed from materials received from other domestic and foreign sources. Ohio continued to be the Nation's second leading raw steel-manufacturing State in 1997 with an estimated output of almost 14.2 million metric tons of raw steel, as reported by the American Iron and Steel Institute. Based on USGS data, the State remained the fourth leading producer of primary aluminum in the Nation in 1997. LTV Corp. announced plans to build a $66 million tubing mill in Marion, OH. This location was selected because of its proximity to major interstate highways, rail lines, and prospective customers. North Star BHP, in Delta, OH, rolled its first steel coil in February 1997. The $512 million flat-rolling minimill, a joint venture of North Star Steel Co. and Australia's Broken Hill Proprietary (BHP) Ltd., has an annual capacity of 1.5 million tons.

The following narrative information was provided by the Ohio Department of Natural Resources, Division of Geological Survey[2] (DGS). Based on DGS estimates for 1997, Ohio's combined output of construction aggregates—crushed limestone, crushed sandstone, and sand and gravel—is expected to reach 127million tons. This record-setting production level is attributed to an increase in construction of commercial buildings and an increase in construction of and repairs to highways.

The DGS is currently in the process of developing limestone availability maps for Ohio. They are also working towards developing maps of the surficial deposits of the State. Surficial deposits include clay, gravel, peat, and sand,. The limestone availability maps and the maps of the surficial materials will be very beneficial to the development of Ohio's industrial mineral industries.

Regarding business, Cargill, Inc. purchased the North American salt operations, including those of Ohio, of Akzo-Nobel Salt, Inc. Martin Marietta Aggregates purchased the limestone and sand and gravel operations of American Aggregates Corp. Also, France Stone Co. changed its name to Benchmark Materials.

Two major issues affected Ohio's aggregate industry in 1998. The first was pending legislation on "farmland preservation." This legislation may restrict where pits and quarries can be located. Simultaneously, an issue between Martin Marietta Aggregates and Clinton County zoning officials may cause future local restrictions on the locations of pits and quarries.

Ohio's aggregate industry once again changed leadership. The Ohio Aggregates Association (Ohio's trade association for aggregate producers) is now under the leadership of a former DGS geologist who worked alongside Ohio's mineral industries for the previous 14 years while being employed with the Ohio Department of Natural Resources.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Sherry Weisgarber, formerly a Geologist and Mineral Statistician at the Ohio Division of Geological Survey, authored the text of Ohio minerals industry information.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN OHIO 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Cement, portland	1,050	72,700	W	W	W	W
Clays:						
Common	1,840	7,560	1,960	7,450	2,020	9,890
Fire	89	3,140	103	3,230	80	3,050
Gemstones	NA	3	NA	153	NA	W
Lime	1,920	117,000	2,020	107,000	2,040	109,000
Sand and gravel:						
Construction	45,300	196,000	46,600	215,000	47,000	222,000
Industrial	1,270	28,800	1,270	29,800	1,270	30,600
Stone:						
Crushed	60,900	265,000	63,600	291,000	69,000	324,000
Dimension metric tons	17,900	1,670	19,800	2,060	19,900	2,070
Combined value of cement (masonry), gypsum (crude), peat, salt, silica stone (1996), and values indicated by symbol W	XX	200,000	XX	314,000	XX	284,000
Total	XX	891,000	XX	969,000	XX	984,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
OHIO: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone 2/	83	46,000	$206,000	$4.47	89	48,200	$226,000	$4.70
Dolomite	20	14,900	58,800	3.95	20	15,400	63,900	4.15
Sandstone	3	74	419	5.66	4	42	155	3.69
Total	XX	60,900	265,000	4.35	XX	63,600	291,000	4.57

XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes "limestone-dolomite," reported with no distinction between the two.

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TABLE 3
OHIO: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit Value
Coarse aggregate (+1 1/2 inch):			
Macadam	378	$1,990	$5.25
Riprap and jetty stone	645	3,040	4.71
Filter stone	11	60	5.45
Other coarse aggregate	640	2,940	4.59
Coarse aggregate, graded:			
Concrete aggregate, coarse	5,350	22,200	4.14
Bituminous aggregate, coarse	2,280	8,970	3.94
Bituminous surface-treatment aggregate	1,120	5,820	5.19
Railroad ballast	479	1,680	3.50
Other graded coarse aggregate	W	W	5.27
Fine aggregate (-3/8 inch):			
Stone sand, concrete	365	1,280	3.51
Stone sand, bituminous mix or seal	1,000	4,080	4.07
Screening, undesignated	198	925	4.67
Other fine aggregate	W	W	5.00
Coarse and fine aggregates:			
Graded road base or subbase	11,700	43,500	3.72
Unpaved road surfacing	4,200	21,100	5.04
Crusher run or fill or waste	781	3,810	4.87
Other coarse and fine aggregates	808	5,670	7.01
Other construction materials 3/	532	1,610	3.02
Agricultural:			
Agricultural limestone	1,050	5,680	5.43
Other agricultural uses	63	690	10.95
Chemical and metallurgical:			
Cement manufacture	(4/)	(4/)	2.77
Lime manufacture	215	888	4.13
Dead-burned dolomite manufacture	109	1,800	16.51
Flux stone	556	6,860	12.35
Glass manufacture	374	3,720	9.96
Sulfur oxide removal	26	203	7.81
Special:			
Asphalt fillers or extenders	(4/)	(4/)	10.18
Whiting or whiting substitute	(4/)	(4/)	11.89
Other fillers or extenders	305	2,760	9.05
Other specified uses not listed	(4/)	(4/)	4.58
Unspecified: 5/			
Actual	24,700	117,000	4.74
Estimated	4,190	17,200	4.10
Total	63,600	291,000	4.57

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Includes dolomite, limestone, limestone-dolomite, and sandstone.
2/ Data are rounded to three significant digits except unit values; may not add to totals shown.
3/ Includes building products.
4/ Withheld to avoid disclosing company proprietary data; included in "Total."
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
OHIO: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 3		District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:										
Coarse aggregate (+1 1/2 inch) 3/	321	1,200	585	2,500	57	342	W	W	W	W
Coarse aggregate, graded 4/	W	W	3,090	12,300	W	W	W	W	W	W
Fine aggregate (-3/8 inch) 5/	568	2,080	555	2,120	W	W	W	W	30	144
Coarse and fine aggregate 6/	W	W	4,100	17,700	W	W	1,670	10,600	W	W
Other construction materials 7/	1,350	50,500	26	111	3,840	17,000	685	4,430	1,460	7,580
Agricultural 8/	650	3,580	152	1,100	(9/)	(9/)	(9/)	(9/)	(9/)	(9/)
Chemical and metallurgical 10/	(9/)	(9/)	(9/)	(9/)	--	--	--	--	--	--
Special 11/	(9/)	(9/)	(9/)	(9/)	--	--	--	--	--	--
Unspecified: 12/										
Actual	7,860	33,300	5,540	26,300	(9/)	(9/)	(9/)	(9/)	(9/)	(9/)
Estimated	2,060	7,590	1,250	5,790	538	2,320	24	111	310	1,350
Total	27,000	113,000	16,500	74,400	11,700	58,800	2,670	16,600	5,860	27,400

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Production reported in District 2 was included with "District 3" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregate.
7/ Includes building products.
8/ Includes agricultural limestone and other agricultural uses.
9/ Withheld to avoid disclosing company proprietary data; included in "Total."
10/ Includes cement manufacture, dead-burn dolomite manufacture, flux stone, glass manufacture, lime manufacture, and sulfur oxide removal.
11/ Includes asphalt fillers or extenders, other fillers or extenders, other specified uses not listed, and whiting or whiting substitute.
12/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
OHIO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	8,510	$41,300	$4.86
Plaster and gunite sands	177	724	4.09
Concrete products (blocks, bricks, pipe, decorative, etc.)	904	4,710	5.21
Asphaltic concrete aggregates and other bituminous mixtures	3,700	18,500	5.00
Road base and coverings 2/	3,600	18,200	5.07
Fill	4,870	20,400	4.19
Snow and ice control	148	537	3.63
Filtration	46	269	5.85
Other miscellaneous uses 3/	1,070	5,350	5.00
Unspecified: 4/			
Actual	18,200	80,200	4.41
Estimated	5,400	24,200	4.49
Total or average	46,600	215,000	4.60

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes railroad ballast and roofing granules.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
OHIO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	212	780	3,780	18,600	2,640	11,800
Asphaltic concrete aggregates and road base materials 3/	177	593	3,960	18,500	3,160	12,600
Other miscellaneous uses 4/	346	1,280	152	805	451	2,690
Unspecified: 5/						
Actual	16	71	2,310	11,900	11,600	49,200
Estimated	236	915	1,360	7,660	304	1,260
Total	986	3,640	11,600	57,500	18,200	77,400
	District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	875	4,180	1,900	10,600	183	804
Asphaltic concrete aggregates and road base materials 3/	2,200	11,300	2,290	12,100	526	2,640
Other miscellaneous uses 4/	26	118	140	718	--	--
Unspecified: 5/						
Actual	2,270	11,300	307	1,530	1,640	6,340
Estimated	837	3,540	1,300	4,930	1,360	5,940
Total	6,210	30,400	5,940	29,800	3,720	15,700

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill, road and other stabilization (cement and lime), and snow and ice control.
4/ Includes filtration, railroad ballast, and roofing granules.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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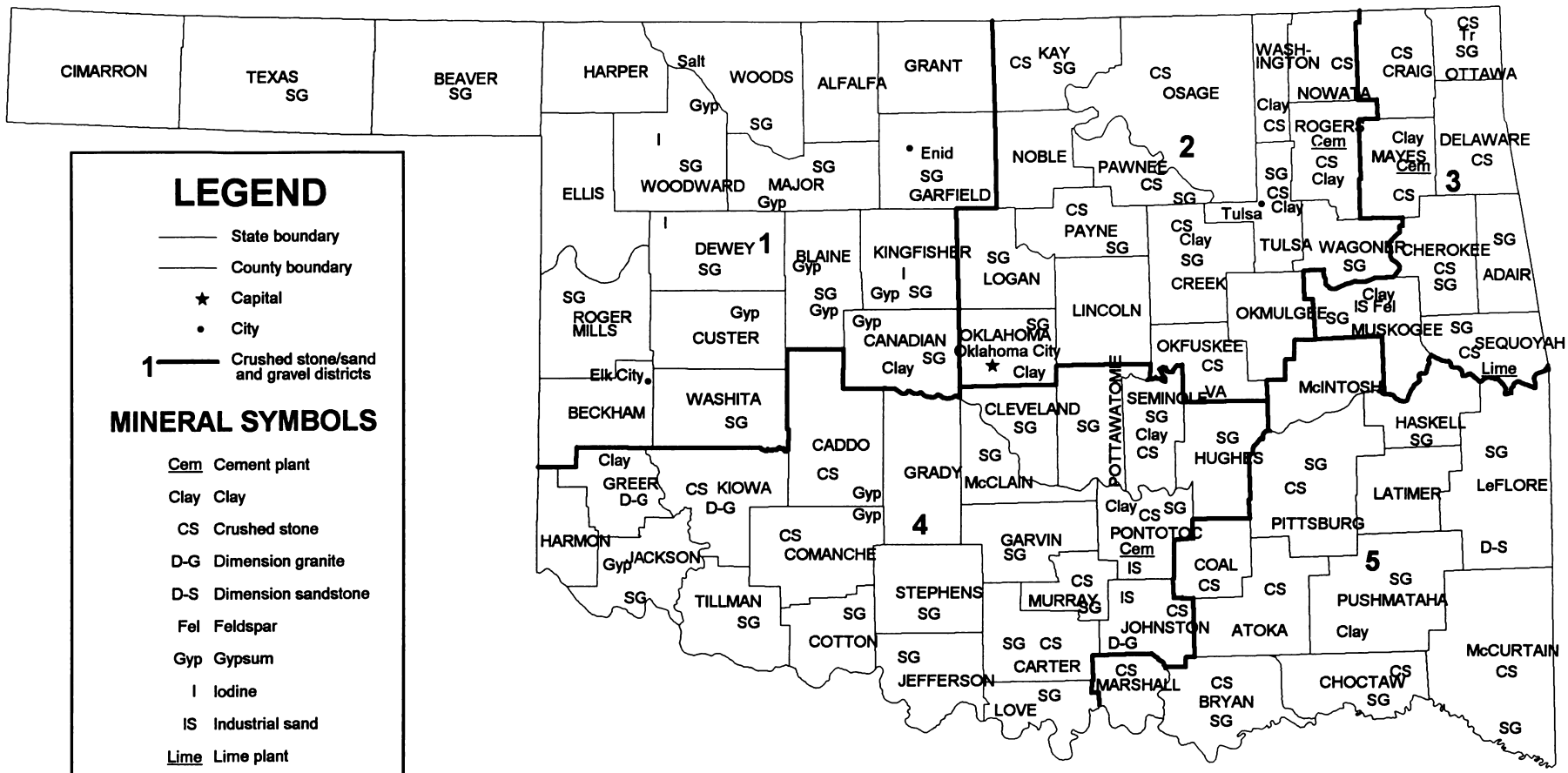
OKLAHOMA



Source: Oklahoma Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF OKLAHOMA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and Oklahoma Geological Survey for collecting information on all nonfuel minerals.

Oklahoma climbed to 32d from 34th in rank among the 50 States in total nonfuel mineral production value[1] in 1997, according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $411 million, a more than 11% increase over that of 1996. This increase followed a 3.4% increase from 1995 to 1996 (based on final 1996 data). The State accounted for 1% of the U.S. total nonfuel mineral production value.

In 1997, crushed stone and portland cement continued as Oklahoma's top two nonfuel mineral commodities, accounting for about 33% and 30%, respectively, of the State's total nonfuel mineral value. The combined values of construction materials—crushed stone, portland and masonry cements, construction sand and gravel, and gypsum, in descending order of value—accounted for 77% of the total value. Oklahoma's increase in value in 1997 mostly resulted from the higher values of crushed stone, iodine, salt, construction sand and gravel, and portland cement, in descending order of increase (*table 1*). Only common and fire clays and crude helium showed relatively small value decreases, while industrial sand and gravel and feldspar remained at the same levels. In 1996, an increase in portland cement was balanced out by an equal decrease in crushed stone. Most other nonfuel minerals had relatively small increases in value, resulting in the State's net increase.

Oklahoma's mines exclusively produced industrial minerals; no metals were mined in the State. Based on USGS estimates of the quantities produced in the 50 States during 1997, Oklahoma remained the only State that produced iodine; first in crude gypsum; second of four States producing tripoli; third of three crude helium-producing States; fifth in feldspar; and eighth in industrial sand and gravel. Additionally, significant quantities of crushed stone, portland and masonry cements, and common clays were produced in the State.

The following narrative information was provided by the Oklahoma Geological Survey[2] (OGC), which reported that industrial-mineral activity in the State continued to increase during 1997. Production has been level or has been rising steadily over the past several years for several of the major commodities, including gypsum for wallboard and plasters; crushed stone for aggregate, railroad ballast, and fill; cement for highways, housing, and commercial buildings; iodine for pharmaceuticals, disinfectants, and animal feed; dimension stone for houses and commercial buildings; and sand and gravel for various construction projects. Construction activities that held steady or increased somewhat in 1997 included highway construction and residential and commercial building.

In 1997, gypsum production dropped slightly, but the price underwent a moderate increase. Most Oklahoma wallboard plants operated at near-capacity during the year, and there was little room to expand to meet the rising national and regional demand. Republic Gypsum Co. is now adding a second board line at its plant in Duke, Jackson County (southwest Oklahoma): this will significantly increase the company's capacity by the end of 1998.

Crushed stone demand rose in 1997, due largely to highway construction, the need for granite and rhyolite as railroad ballast, and the need for aggregate on roads and drilling pads in the oil and gas drilling business. Most Oklahoma highways are now being built with a concrete surface, which increases the demand for aggregate and cement.

Iodine production increased slightly during 1997, but the value rose significantly above that of 1996. The price of iodine held steady at about $18 per kilogram during most of the year, which was a significant increase over the $11 to $15 per kilogram price in 1996. Three companies are operating four facilities in northwest Oklahoma, and the companies have drilled several new producing wells during the year.

The number of mining permits in Oklahoma dropped slightly in 1997, but the acreage under permit has risen. The Oklahoma Department of Mines (ODM) issued a total of 435 permits in 1997, covering a total of about 17,000 hectares. According to ODM, many more companies are opting to obtain a Life Expectancy Permit, as allowed under the State's 1994 law. Under this law, a company may submit a mining plan only once to cover the mine's life expectancy, instead of undergoing a permit review every 5 years. Of permits on file for 1997, ODM reports that 174 (40%) have been secured under the "life expectancy" provision.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Kenneth S. Johnson, Associate Director of the Oklahoma Geological Survey, authored the text of State minerals information submitted by the agency.

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Oklahoma is scheduled to host the 34th Forum on the Geology of Industrial Minerals on May 2-6, 1998, in Norman. This prestigious annual meeting will be attended by about 150 specialists in the geology, production, and marketing of a wide range of industrial minerals throughout the United States and elsewhere in the world.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN OKLAHOMA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Cement:							
Masonry		95	7,250	101	8,850 e/	103	9,200 e/
Portland		1,740	110,000	1,750	118,000 e/	1,780	122,000 e/
Clays:							
Common		674	3,580	799	4,090	772	3,550
Fire		--	--	23	W	--	--
Gemstones		NA	W	NA	603	NA	995
Gypsum, crude		2,830	17,000	2,690	16,500	2,610	18,400
Iodine, crude	metric tons	1,210	12,500	1,270	14,600	1,330	24,000
Sand and gravel:							
Construction		7,800	25,100	7,910	27,700	9,120	32,700
Industrial		1,250	25,400	1,350	27,200	1,350	27,200
Stone:							
Crushed 3/		31,100	125,000	28,300	117,000	31,500	134,000
Dimension	metric tons	9,170 3/	2,350 3/	9,710	2,220	9,760	2,230
Combined value of feldspar, helium [crude, Grade-A (1996-97)], lime, salt, stone [crushed shell and traprock, dimension quartzite and sandstone (1995)], tripoli (1995-96), and values indicated by symbol W		XX	28,700	XX	32,300	XX	36,000
Total		XX	357,000	XX	369,000	XX	411,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined value" figure.

TABLE 2
OKLAHOMA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone	46 r/	21,700 r/	$88,500 r/	$4.07	45	21,000	$82,800	$3.95
Dolomite	5 r/	3,830 r/	16,100 r/	4.20	5	2,990	12,600	4.20
Granite	3	W	W	5.21	3	W	W	5.15
Traprock	1	1,490	(2/)	(2/)	(2/)	(2/)	(2/)	(2/)
Sandstone	5	W	W	4.93	6	W	W	4.96
Shell	(2/)	(2/)	(2/)	(2/)	(2/)	(2/)	(2/)	(2/)
Slate	1	12	66	5.50	1	15	84	5.60
Miscellaneous stone	1	27	118	4.37	1	91	402	4.42
Total	XX	31,100	125,000	4.01	XX	28,300	117,000	4.14

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excludes shell and traprock (1995 value only) from State total to avoid disclosing company proprietary data.

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TABLE 3
OKLAHOMA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	140	$987	$7.05
Filter stone	81	433	5.35
Other coarse aggregate	W	W	5.00
Coarse aggregate, graded:			
Concrete aggregate, coarse	2,550	13,000	5.10
Bituminous aggregate, coarse	997	5,860	5.87
Bituminous surface-treatment aggregate	367	2,390	6.52
Railroad ballast	697	3,820	3.34
Other graded coarse aggregate	W	W	4.81
Fine aggregate (-3/8 inch):			
Screening, undesignated	966	2,320	2.40
Other fine aggregate 3/	356	1,450	4.08
Coarse and fine aggregates:			
Graded road base or subbase	2,170	7,890	3.64
Unpaved road surfacing	W	W	4.88
Terrazzo and exposed aggregate	W	W	4.83
Crusher run or fill or waste	1,650	6,450	3.90
Other coarse and fine aggregates	W	W	3.92
Other construction materials 4/	348	1,500	4.32
Agricultural limestone	(5/)	(5/)	3.82
Chemical and metallurgical:			
Cement manufacture	(5/)	(5/)	2.81
Flux stone	(5/)	(5/)	4.54
Special, other fillers or extenders	(5/)	(5/)	6.62
Unspecified: 6/			
Actual	13,700	55,500	4.05
Estimated	1,910	7,530	3.95
Total	28,300	117,000	4.14

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Includes dolomite, granite, limestone, miscellaneous stone, sandstone, and slate;excludes shell and traprock from State total to avoid disclosing companyproprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes stone sand (concrete) and stone sand (bituminous mix or seal).
4/ Includes lightweight aggregate (slate).
5/ Withheld to avoid disclosing company proprietary data; included in "Total."
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
OKLAHOMA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE AND DISTRICT 1/ 2/ 3/

(Thousand metric tons and thousand dollars)

Use	District 2		District 3		District 4		District 5	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 4/	86	515	W	W	W	W	W	W
Coarse aggregate, graded 5/	1,250	7,050	W	W	W	W	W	W
Fine aggregate (-3/8 inch) 6/	767	1,890	W	W	W	W	W	W
Coarse and fine aggregate 7/	1,780	6,470	W	W	W	W	1,050	4,160
Other construction materials 8/	--	--	1,450	6,130	1,780	8,630	2,160	11,200
Agricultural 9/	(10/)	(10/)	(10/)	(10/)	--	--	(10/)	(10/)
Chemical and metallurgical 11/	(10/)	(10/)	--	--	(10/)	(10/)	(10/)	(10/)
Special 12/	--	--	--	--	(10/)	(10/)	--	--
Unspecified: 13/								
Actual	2,690	13,000	(10/)	(10/)	8,890	35,800	658	2,840
Estimated	108	250	195	788	816	3,300	788	3,190
Total	7,700	31,400	3,130	10,800	12,500	52,200	4,990	22,900

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ No crushed stone was produced in District 1.
2/ Excludes shell and traprock from State total to avoid disclosing company proprietary data.
3/ Data are rounded to three significant digits; may not add to totals shown.
4/ Includes filter stone, riprap and jetty stone, and other coarse aggregate.
5/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and othergraded coarse aggregate.
6/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
7/ Includes graded road base or subbase, unpaved road surfacing, terrazzo and exposed aggregate, crusher run (select material or fill), and other coarse and fine aggregate
8/ Includes lightweight aggregate (slate).
10/ Withheld to avoid disclosing company proprietary data; included in "Total."
11/ Includes cement manufacture and flux stone.
12/ Includes other fillers or extenders.
13/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
OKLAHOMA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	3,210	$13,200	$4.11
Plaster and gunite sands	1	5	5.00
Concrete products (blocks, bricks, pipe, decorative, etc.)	152	530	3.49
Asphaltic concrete aggregates and other bituminous mixtures	308	745	2.42
Road base and coverings 2/	407	1,170	2.88
Fill	990	1,680	1.69
Other miscellanous uses	2	27	13.50
Unspecified: 3/			
Actual	1,490	6,100	4.09
Estimated	1,340	4,240	3.16
Total or average	7,910	27,700	3.50

1/ Data are rounded to three significant digits, except value per ton; may not add to totals shown.
2/ Includes road and other stabilization (cement) and snow and ice control.
3/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
OKLAHOMA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	235	896	1,560	4,640	1,570	8,190
Asphaltic concrete aggregates and road base materials 4/	348	804	847	1,620	510	1,170
Other miscellaneous uses	2	27	--	--	--	--
Unspecified: 5/						
Actual	739	2,530	--	--	752	3,570
Estimated	53	328	569	1,920	720	1,990
Total	1,380	4,580	2,980	8,190	3,550	14,900

1/ Production reported in District 3 and 5 was included with "District 4" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Includes fill, and snow and ice control.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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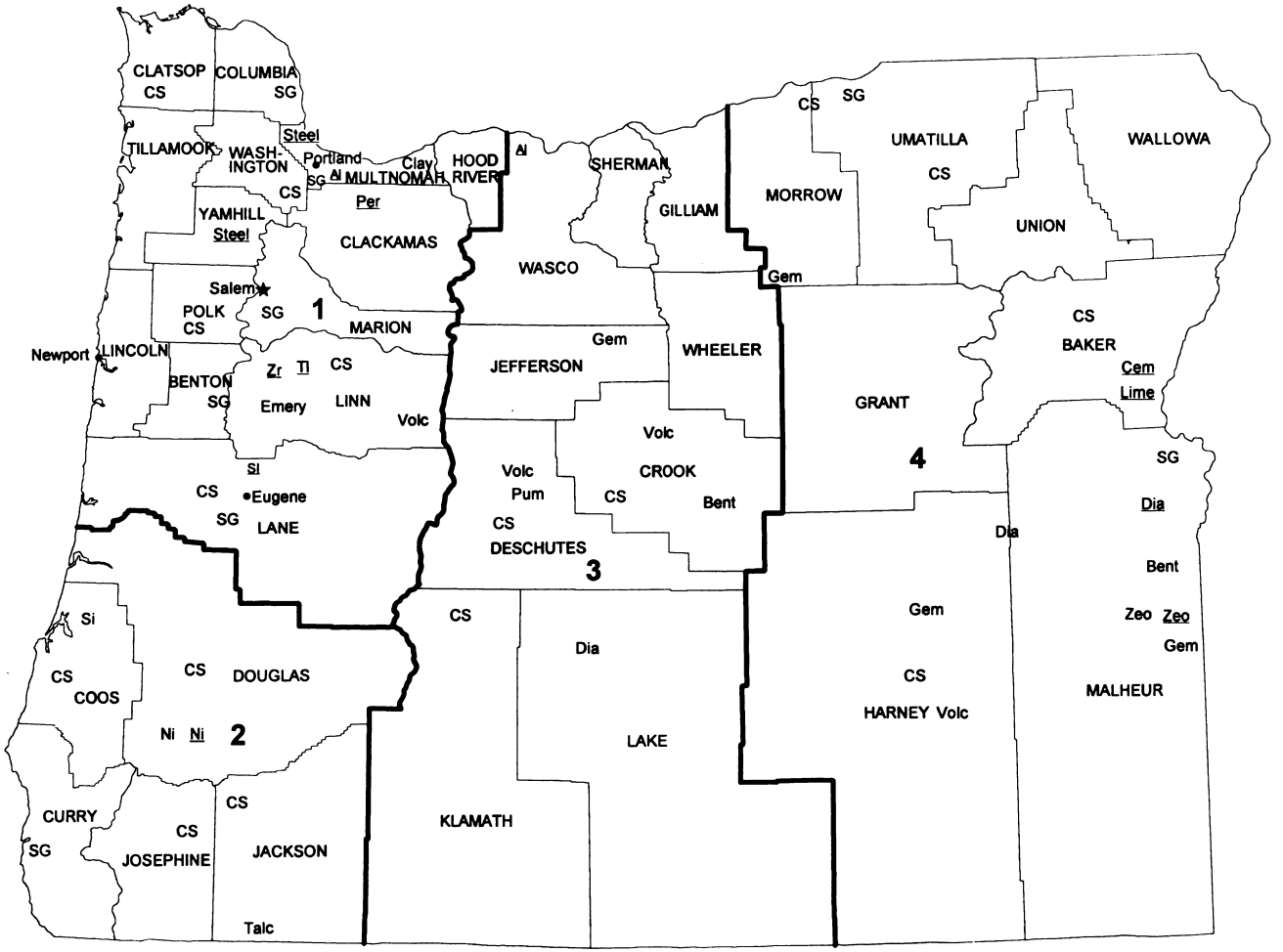
OREGON



LEGEND

- State boundary
- County boundary
- ★ Capital
- • City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Al	Aluminum plant
Bent	Bentonite
Cem	Cement plant
Clay	Clay
CS	Crushed stone
Dia	Diatomite
Dia	Diatomite plant
Emery	Emery
Gem	Gemstone
Lime	Lime plant
Per	Perlite plant
Pum	Pumice
SG	Sand and gravel
Si	Silica
Si	Silicon plant
Steel	Steel plant
Talc	Talc minerals
Ti	Titanium plant
Volc	Volcanic cinders
Zeo	Zeolites
Zeo	Zeolite plant
Zr	Zirconium plant

0 50 Kilometers

Source: Oregon Department of Geology and Mineral Industries/U.S. Geological Survey

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THE MINERAL INDUSTRY OF OREGON

In 1997, Oregon ranked 38th in the Nation in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The State was 37th in 1996. The estimated value for 1997 was $272 million, about a 3% increase compared with that of 1996. This followed a 10.8% increase from 1995 to 1996 (based on final 1996 data). The State accounted for less than 1% of the U.S. total nonfuel mineral production value.

Industrial minerals accounted for all of Oregon's raw nonfuel mineral production value. Construction sand and gravel and crushed stone, by value, are Oregon's two leading nonfuel mineral commodities, accounting for nearly 74% of the State's total value in 1997. A $15 million increase in the value of construction sand and gravel more than compensated for decreases in the values of gemstones and crushed stone (*table 1*), resulting in Oregon's net gain in nonfuel mineral production value for the year. All other minerals showed at least a small increase, except for nickel, for which there was no domestic mine production. Production of common clays remained the same. The Glenbrook Nickel Co., a joint venture of Cominco American Inc. and Cominco Resources International Ltd., operated its smelter in Riddle at full capacity during 1997. The company received its ore from foreign sources, mostly garneritic laterite ore from Société Minière du Sud Pacifique of New Caledonia. The Nickel Mountain Mine was idle all of 1997 because of low nickel prices and the ore's nickel content, which was lower than the ore from foreign sources. Nickel Mountain has been the sole domestic producer of primary nickel in the United States in recent years, operating on an intermittent basis—mine production depending on the price of nickel.

Based on USGS estimates of the quantities of raw minerals produced in the United States during 1997, Oregon remained first among the 50 States in pumice and pumicite, the only State to produce emery, third in diatomite and zeolites, and seventh in bentonite. The State dropped in rank from second to sixth in gemstones (by value). Additionally, significant quantities of construction sand and gravel and crushed stone were produced in the State.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN OREGON 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Clays:							
Bentonite		17	917	33	1,530	34	1,560
Common		222	354	213	154	213	154
Gemstones		NA	4,570	NA	6,730	NA	1,940
Nickel ore	metric tons	1,560	W	1,330	W	– 3/	–
Sand and gravel, construction		18,200	85,000	18,300	86,800	20,900	102,000
Stone, crushed		20,700	95,700	22,000	102,000	20,800	98,000
Talc and pyrophyllite	metric tons	W	W	64	84	W	W
Combined value of cement (portland), diatomite, emery (1995-96), lime, pumice and pumicite, zeolites, indicated by symbol W		XX	52,500	XX	67,100	XX	68,100
Total		XX	239,000	XX	265,000	XX	272,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Quantity of local ore fed to smelter after rejection of lower grade material. The Nickel Mountain Mine reportedly was idle all of 1997 because of disappointing prices for nickel ore. However, the smelter operated at full capacity. Since 1992, the smelter has been using lateritic ore imported from New Caledonia in addition to lateritic ore mined on Nickel Mountain. In a normal year, the value reflects the grade of the local ore, the projected average unit customs value for competing ore imported from New Caledonia, and the average reported by the London Metal Exchange ($6,927 per metric ton Ni in 1997).

TABLE 2
OREGON: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone	1	W	W	$4.96	1	W	W	$5.42
Granite	27	47	$234	4.98	27	70	$306	4.37
Traprock	285 r/	18,400 r/	85,300 r/	4.62 r/	288	19,700	91,000	4.61
Sandstone and quartzite	67	380	1,960	5.15	67	389	1,770	4.56
Slate	1	W	W	6.04	1	W	W	5.07
Volcanic cinder and scoria	50 r/	35	221	6.31	50	35	221	6.31
Shell	1	W	W	3.67	1	W	W	3.31
Miscellaneous stone	33 r/	695 r/	2,680 r/	3.85 r/	33	510	2,560	5.01
Total	XX	20,700	95,700	4.63	XX	22,000	102,000	4.65

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 3
OREGON: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	65	$218	$3.35
Riprap and jetty stone	291	970	3.33
Filter stone	141	570	4.04
Other coarse aggregate	125	523	4.18
Coarse aggregate, graded:			
Concrete aggregate, coarse	594	2,500	4.21
Bituminous aggregate, coarse	704	3,840	5.46
Bituminous surface-treatment aggregate	517	2,770	5.36
Railroad ballast	55	443	8.05
Other graded coarse aggregate	142	646	1.12
Fine aggregate (-3/8 inch):			
Stone sand, bituminous mix or seal	133	894	6.72
Screening, undesignated	144	457	3.17
Other fine aggregate 3/	29	221	7.62
Coarse and fine aggregates:			
Graded road base or subbase	5,880	28,800	4.89
Unpaved road surfacing	1,780	8,180	4.60
Terrazzo and exposed aggregate	66	260	3.94
Crusher run or fill or waste	1,900	5,170	2.72
Other coarse and fine aggregates	419	1,560	3.72
Other construction materials 4/	16	20	1.25
Chemical and metallurgical, cement manufacture	(5/)	(5/)	3.98
Other miscellaneous uses:			
Sugar refining	(5/)	(5/)	10.86
Other specified uses not listed	(5/)	(5/)	7.18
Unspecified: 6/			
Actual	4,480	22,700	5.07
Estimated	3,530	16,100	4.58
Total	22,000	102,000	4.65

1/ Includes granite, limestone, miscellaneous stone, sandstone and quartzite, shell, slate, traprock, and volcanic cinder and scoria.
2/ Data are rounded to three significant digits except unit value; may not add to totals shown.
3/ Includes stone sand (concrete).
4/ Includes drain fields.
5/ Withheld to avoid disclosing company proprietary data; included in "Total."
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
OREGON: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	496	1,770	W	W	W	W
Coarse aggregate, graded 3/	1,490	7,120	W	W	227	1,890
Fine aggregate (-3/8 inch) 4/	110	673	--	--	W	W
Coarse and fine aggregate 5/	6,700	29,800	2,070	8,740	616	2,980
Other construction materials 6/	--	--	182	667	59	348
Chemical and metallurgical 7/	--	--	--	--	--	--
Other miscellaneous uses 8/	(9/)	(9/)	--	--	--	--
Unspecified: 10/						
Actual	(9/)	(9/)	19	87	--	--
Estimated	2,190	9,990	309	845	439	1,900
Total	13,800	66,100	2,580	10,300	1,340	7,120

Use	District 4		District unspecified	
	Quantity	Value	Quantity	Value
Construction aggregates:				
Coarse aggregate (+1 1/2 inch) 2/	46	202	--	--
Coarse aggregate, graded 3/	W	W	--	--
Fine aggregate (-3/8 inch) 4/	W	W	--	--
Coarse and fine aggregate 5/	658	2,460	--	--
Other construction materials 6/	393	1,580	--	--
Chemical and metallurgical 7/	(9/)	(9/)	--	--
Other miscellaneous uses 8/	(9/)	(9/)	--	--
Unspecified: 10/				
Actual	(9/)	(9/)	835	1,980
Estimated	--	--	583	3,400
Total	2,880	13,300	1,420	5,380

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
6/ Includes drain fields.
7/ Includes cement manufacture.
8/ Includes sugar refining and other specified uses not listed.
9/ Withheld to avoid disclosing company proprietary data; included in "Total."
10/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 5
OREGON: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products 2/	5,400	$24,500	$4.53
Asphaltic concrete aggregates and other bituminous mixtures	1,250	7,350	5.87
Road base and coverings	3,730	18,600	4.98
Fill	957	3,180	3.32
Snow and ice control	19	141	7.42
Other miscellaneous uses 3/	596	2,690	4.51
Unspecified: 4/			
Actual	2,280	9,170	4.02
Estimated	4,020	21,300	5.29
Total or average	18,300	86,800	4.75

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes railroad ballast.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 6
OREGON: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	4,160	18,300	776	3,270	463	2,860
Asphaltic-bituminous mixtures	849	5,310	335	1,750	67	292
Road base and coverings 4/	3,780	18,100	472	1,800	455	2,020
Other miscellaneous uses 5/	545	2,380	51	309	--	--
Unspecified: 6/						
Actual	1,940	7,890	245	826	96 7/	459 7/
Estimated	3,570	19,000	41	207	412 7/	2,100 7/
Total	14,800	70,900	1,920	8,160	1,490 7/	7,720 7/

1/ Production reported in District 3 was included with "District 4" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Includes fill, and snow and ice control.
5/ Includes railroad ballast.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.
7/ Includes production within the State with no district reported.

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PENNSYLVANIA

LEGEND

- State boundary
- County boundary
- ★ Capital
- • City
- 1 Crushed stone/sand and gravel districts

CC-Sh	Common clay and shale
Cem	Cement plant
CS	Crushed stone
D-G	Dimension granite
D-S	Dimension sandstone
D-SL	Dimension slate

MINERAL SYMBOLS

IS	Industrial sand
Lime	Lime plant
Mica	Mica
Peat	Peat
SG	Sand and gravel
Steel	Iron and steel plant
Zn	Zinc plant

Concentration of mineral operations

0 — 50 Kilometers

Source: Pennsylvania Bureau of Topographic and Geologic Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF PENNSYLVANIA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Pennsylvania Topographic and Geologic Survey for collecting information on all nonfuel minerals.

Pennsylvania continued to rank 11th among the 50 States in total nonfuel mineral production value[1] in 1997, according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $1.24 billion, a 6% increase from that of 1996. This followed an 8.3% increase from 1995 to 1996 (based on final 1996 data). The State accounted for more than 3% of the U.S. total nonfuel mineral production value.

Pennsylvania continued to be among the Nation's leading producers of crushed stone, portland cement, lime, and masonry cement (in descending order of value); these four commodities accounted for nearly 92% of the State's total nonfuel mineral production value. In 1997, most minerals increased in value, led by crushed stone with a $50 million gain and portland cement with a rise of $17 million (*table 1*). Only construction sand and gravel and common clays showed small decreases for the year. In 1996, a combined increase of $89 million in the values of portland cement and crushed stone accounted for most of the year's increase. Masonry cement and industrial sand and gravel also increased in value that year.

Based on USGS estimates of the quantities produced in the 50 States in 1997, Pennsylvania remained first in crushed stone; third in portland cement; fourth of four States that produce tripoli; fifth in lime and masonry cement; and seventh in dimension stone. Additionally, significant quantities of construction and industrial sand and gravel and common clays were produced in the State.

Pennsylvania is exclusively an industrial mineral- and coal-producing State; metals that were produced in the State, especially steel, were processed from materials received from other domestic or foreign sources. Pennsylvania continued to be the Nation's third leading raw steel-manufacturing State with an estimated output of almost 7.3 million metric tons of raw steel, as reported by the American Iron and Steel Institute. Bethlehem Steel Corp., Bethlehem, PA, continued a year-long corporate restructuring process, which began in October 1996. Bethlehem signed with Lukens, Inc., Coatesville, PA, a merger agreement that would result in Bethlehem acquiring Lukens for about $650 million, including an assumption of about $250 million in debt. Bethlehem announced its intent to discontinue operations at it's Coke Division and to sell its coal mining operation in West Virginia. Bethlehem also sold its BethShip shipyard and Centec and BethForge operations and closed its Structural Products facility.

The following narrative information was provided by the Pennsylvania Geological Survey.[2] Pennsylvania's mining activities have changed little over the past 3 years. The State traditionally produces over 150 million tons of nonfuel mineral production worth more than $1 billion annually (USGS data). More than 90% of this value and tonnage is consumed in the construction markets. On a tonnage basis, Pennsylvania produces more nonfuel mineral commodities than coal. Almost 80% of the bituminous coal production is now derived from deep mines.

Exploration continued, especially for industrial minerals, to both replace reduced and depleted reserves, as well as to expand reserves and meet new consumer demands. Annually, new mining applications request approximately 4,000 hectares of land area for actual mining operations (coal and industrial minerals).

The production of crushed stone continued to increase, accounting for an estimated 93 million tons in 1997 (87.4 million tons in 1996) representing about 46% of the total nonfuel mineral value in the Commonwealth (*tables 1-3*). To meet this demand, 15 producers sought new mining permits totaling more than 485 hectares. Approximately 20% of these applications were expansions to existing operations. Crushed stone quarries average about 32 hectares each in size, which in terms of numbers and acreage are divided equally between eastern and western Pennsylvania. Approximately 55% of these applications, filed with the Department of Environmental Protection (DEP), were for carbonate bedrock sources whereas approximately 35% were for sandstone sources.. A glass sand producer in the central portion of the State expanded mining operations northward along strike in Devonian-age sandstone. Carboniferous age limestones in western Pennsylvania remain one of the few sources of quality aggregate and carbonate for cement manufacture in the Appalachian Plateau physiographic

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Samuel Berkheiser authored the text of Pennsylvania mineral industry information.

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province. Underground mining of industrial minerals is not uncommon in flat, relatively thin (not exceeding 18 meters in thickness) carbonate beds, as attested to by a 62-hectare permit application to mine the Loyalhanna Formation, a siliceous limestone.

Sand and gravel production is limited primarily to the formerly glaciated portions of northwestern and northeastern Pennsylvania where the population density is generally less than elsewhere. The State commonly averages approximately 15 million tons of sand and gravel production annually. These operations are generally much smaller than crushed stone operations, averaging about 14 hectares per site. More than 162 hectares of sand and gravel permits were applied for by 10 operators in northwestern Pennsylvania, while more than 6 operators in the northeastern portion of the State sought 40 hectares.

The lime industry reported a small decrease in production in 1997. U.S. Lime and Minerals' Corson Lime Co., its subsidiary in Montgomery County, shut down after 175 years in operation. Carmeuse SA of Belgium purchased Tarmac America Inc.'s two lime plants in Adams and Lebanon Counties (formerly owned by Wimpey Minerals PA, Inc.).

According to USGS compilations, the annual value of the Commonwealth's dimension stone industry has begun to stabilize slightly below the recent peak years of 1994 and 1995, and more than 15% above the levels of the early 1990's. This appears to be fueled by the demand for quality stone products in a largely colonial architectural market area. Major contributors to this niche are the flagstone (bluestone) producers in the northeastern portion of the State, slate producers in the north-central portion of the State, and diabase producers in the southeastern portion of the State. There are currently more than 100 permitted bluestone quarries, usually less than 2 hectares in size, located in the northeastern portion of the State. Susquehanna County is the focus of most flagstone mining efforts. A new diabase (black granite) operation has opened near Gettysburg, which will help satisfy the demand for dark-colored memorial stone applications. At least seven new sandstone building stone operations have applied for small operator permits throughout the State, according to DEP records. Other potential sources of dimension stone, including some carbonates, are currently being explored for and evaluated.

Another measure of the health of the construction industry is seen in 37 new borrow- and-fill permits that were sought in 22 of Pennsylvania's 67 counties. Most of these pits are small, less than 2-hectare operations, producing less than 1,810 tons per year. Similarly, five new topsoil mines sought permits accounting for a cumulative acreage exceeding 40 hectares. Most of this material is custom blended with other materials such as peat and sand for agricultural purposes.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN PENNSYLVANIA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995		1996		1997 p/	
		Quantity	Value	Quantity	Value	Quantity	Value
Cement:							
Masonry		267	21,200	274	28,000 e/	280	29,100 e/
Portland		5,610	355,000	5,670	418,000 e/	5,790	435,000 e/
Clays:							
Common		736	2,430	753	2,420	630	1,960
Kaolin		14	815	14	815	14	815
Gemstones		NA	1	NA	1	NA	1
Lime		1,640	107,000	1,530	105,000	1,550	106,000
Peat		11	294	4	166	8	181
Sand and gravel, construction		17,100	93,100	15,100	85,600	14,500	84,400
Stone:							
Crushed		80,900	492,000	87,400	518,000	93,000	568,000
Dimension	metric tons	57,600	12,300	54,300	11,800	54,600	11,800
Total 3/		XX	1,080,000	XX	1,170,000	XX	1,240,000

e/ Estimated. p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Partial total, excludes values for industrial sand and gravel and tripoli, which must be concealed to avoid disclosing company proprietary data.

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TABLE 2
PENNSYLVANIA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousands metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone 2/	126 r/	47,300 r/	$279,000 r/	$5.91 r/	130	55,200	$318,000	$5.76
Dolomite	16	14,700	91,800	6.25	14	10,800	66,900	6.20
Sandstone and quartzite	36 r/	5,240 r/	33,300 r/	6.35	33	6,020	35,500	5.89
Traprock	9 r/	3,360 r/	25,100 r/	7.46 r/	8	2,810	22,400	7.99
Granite	7	2,660	19,400	7.30	7	4,030	25,800	6.40
Marble	1	433	2,840	6.56	1	464	2,860	6.17
Miscellaneous stone	19 r/	7,220 r/	40,400 r/	5.60 r/	19	8,040	45,700	5.69
Total	XX	80,900	492,000	6.09	XX	87,400	518,000	5.92

r/ Revised. XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes "limestone-dolomite, " reported with no distinction between the two.

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TABLE 3
PENNSYLVANIA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	587	$3,980	$6.79
Riprap and jetty stone	1,390	10,400	7.45
Filter stone	367	2,170	5.91
Other coarse aggregate	440	2,810	6.39
Coarse aggregate, graded:			
Concrete aggregate, coarse	5,080	29,900	5.89
Bituminous aggregate, coarse	7,160	41,800	5.84
Bituminous surface-treatment aggregate	3,220	20,200	6.28
Railroad ballast	890	5,230	5.87
Other graded coarse aggregate	3,440	22,100	6.42
Fine aggregate (-3/8 inch):			
Stone sand, concrete	813	4,500	5.54
Stone sand, bituminous mix or seal	3,210	18,800	5.87
Screening, undesignated	1,620	8,930	5.50
Other fine aggregate	238	1,820	7.65
Coarse and fine aggregates:			
Graded road base or subbase	13,900	71,900	5.19
Unpaved road surfacing	2,120	10,700	5.04
Terrazzo and exposed aggregate	195	1,670	8.54
Crusher run or fill or waste	1,800	9,340	5.21
Other coarse and fine aggregates	3,400	17,500	5.16
Other construction materials 3/	3,290	26,400	8.02
Agricultural:			
Agricultural limestone	494	4,980	10.07
Poultry grit and mineral food	74	437	5.91
Other agricultural uses	59	633	11.22
Chemical and metallurgical:			
Cement manufacture	6,100	29,200	4.78
Lime manufacture	1,250	8,940	7.17
Flux stone	58	385	6.64
Sulfur oxide removal	332	3,410	10.26
Special:			
Mine dusting or acid water treatment	31	471	25.43
Asphalt fillers or extenders	577	4,000	6.94
Whiting or whiting substitute	38	420	11.05
Other fillers or extenders	162	1,640	10.14
Other specified uses not listed	56	486	8.68
Unspecified: 4/			
Actual	12,900	78,300	6.06
Estimated	12,100	74,000	6.11
Total	87,400	518,000	5.92

1/ Includes dolomite, granite, limestone, limestone-dolomite, marble, miscellaneous stone, sandstone and quartzite, and traprock.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes building products and roofing granules.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
PENNSYLVANIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 2/	W	W	W	W	987	7,010	1,090	7,620
Coarse aggregate, graded 3/	W	W	W	W	5,670	37,700	12,400	71,800
Fine aggregate (-3/8 inch) 4/	W	W	W	W	1,150	7,140	3,790	21,600
Coarse and fine aggregate 5/	613	2,490	2,460	12,500	4,170	24,700	14,600	81,500
Other construction materials 6/	1,210	6,320	2,270	13,800	1,630	9,410	1,160	6,650
Agricultural 7/	4	31	(8/)	(8/)	(8/)	(8/)	542	5,060
Chemical and metallurgical 9/	929	7,230	173	2,190	2,020	13,000	4,620	19,500
Special 10/	48	400	(8/)	(8/)	(8/)	(8/)	722	5,100
Unspecified: 11/								
Actual	1,720	9,600	1,700	10,800	1,010	6,750	8,500	51,100
Estimated	3,410	21,800	1,480	7,780	1,480	9,600	5,740	34,800
Total	7,940	47,900	8,140	47,700	18,200	117,000	53,100	305,000

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
6/ Includes building products and roofing granules.
7/ Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes cement manufacture, flux stone, lime manufacture, and sulfur oxide removal.
10/ Includes asphalt fillers or extenders, mine dusting or acid water treatment, other fillers or extenders, and whiting or whiting substitute, and other specified uses not listed.
11/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
PENNSYLVANIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	4,970	$34,200	$6.88
Plaster and gunite sands	108	913	8.45
Concrete products (blocks, bricks, pipe, decorative, etc.)	298	2,250	7.55
Asphaltic concrete aggregates and other bituminous mixtures	1,680	10,500	6.25
Road base and coverings	2,050	10,300	5.06
Fill	1,910	6,000	3.14
Snow and ice control	282	1,730	6.15
Other miscellaneous uses 2/	410	3,100	7.57
Unspecified: 3/			
Actual	1,380	6,470	4.70
Estimated	1,990	10,100	5.08
Total or average	15,100	85,600	5.68

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes railroad ballast, and roofing granules.
3/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
PENNSYLVANIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	964	5,450	1,420	9,390	1,660	13,000	1,330	9,540
Asphaltic/bituminous mixtures	447	2,580	383	2,390	759	4,860	87	648
Road base and coverings	1,390	6,820	165	934	385	2,030	109	561
Fill	112	317	119	732	385	1,710	1,300	3,240
Snow and ice control	76	429	47	387	146	814	13	103
Other miscellaneous uses 3/	189	1,240	20	220	138	982	64	661
Unspecified: 4/								
Actual	444	1,980	384	1,830	312	1,500	238	1,160
Estimated	973	4,130	500	2,990	389	2,070	130	929
Total	4,590	22,900	3,040	18,900	4,170	26,900	3,270	16,800

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes railroad ballast, and roofing granules.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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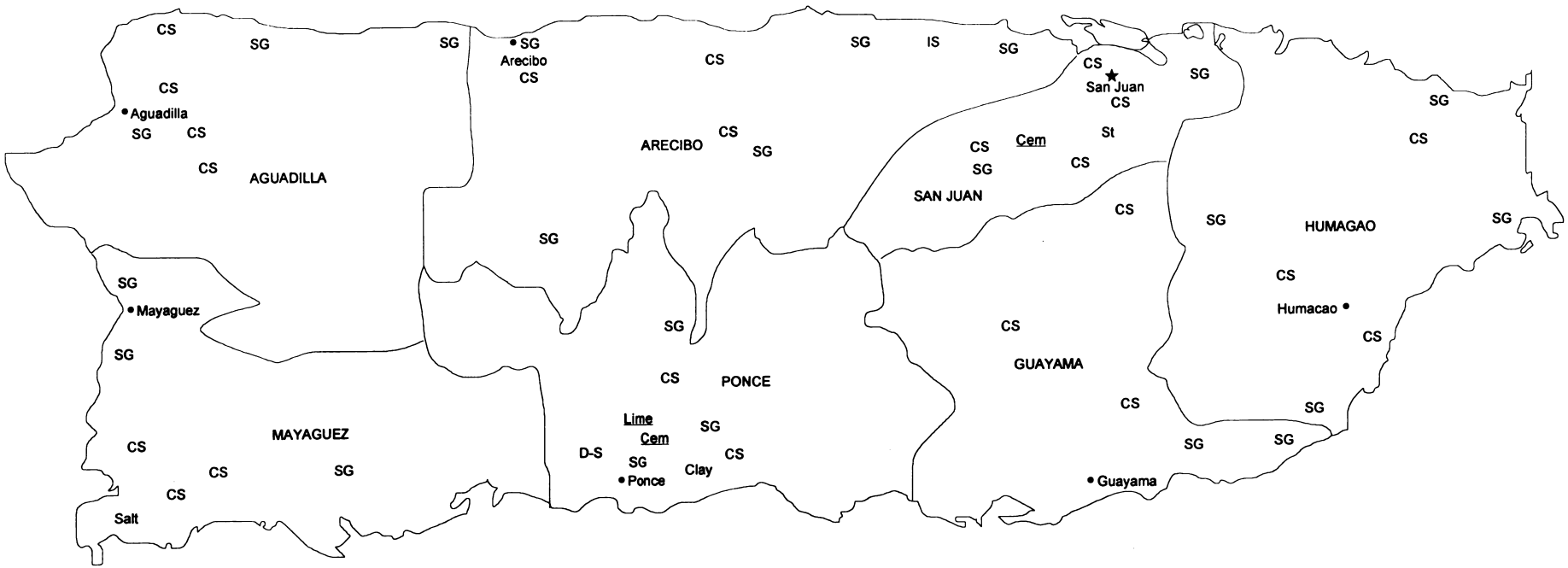
PUERTO RICO



LEGEND		MINERAL SYMBOLS			
State boundary		Cem	Cement plant	Lime	Lime plant
District boundary		Clay	Clay	Salt	Salt
★	Capital	CS	Crushed stone	SG	Sand and gravel
•	City	D-S	Dimension stone	St	Stone
		IS	Industrial sand		

0 100 Kilometers

Source: Department of Natural Resources, Commonwealth of Puerto Rico/U.S. Geological Survey

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THE MINERAL INDUSTRY OF PUERTO RICO AND THE ADMINISTERED ISLANDS

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Department of Natural Resources, Commonwealth of Puerto Rico, for collecting information on all nonfuel minerals.

In 1997, the estimated value[1] of nonfuel mineral commodities produced in Puerto Rico[2] was $217 million, according to the U.S. Geological Survey (USGS). Portland cement and crushed stone by value were the Commonwealth's leading nonfuel mineral commodities. If ranked in comparison with the 50 States, Puerto Rico would rank 39th in total nonfuel mineral production value. Of the U.S. Administered Islands, only crushed stone companies from the island of Guam have of late reported raw mineral production to the USGS. In 1997, portland cement, common clays, and lime values increased; industrial sand and gravel dropped in value. All other nonfuel minerals remained the same. In 1996, the major cause of the drop in Puerto Rico's nonfuel mineral value was a $54.5 million decrease in the value of crushed stone (*table 1*).

Construction sand and gravel is produced on Puerto Rico, but production data do not appear in table 1. The collection and compilation of production data for construction sand and gravel mined in the Commonwealth was discontinued in 1973 by the U.S. Bureau of Mines (the Federal Government agency then responsible for the collection of domestic raw nonfuel mineral production data). This data collection ceased because of low level response by the industry (Sikich and Alonso, 1993). Regarding the U.S. Administered Islands, companies only from the Pacific Island Possessions of Guam and American Samoa have reported production to the USGS during the last several years (*table 1*).

A team of scientists from the U. S. Department of the Interior's Minerals Management Service (MMS) learned that the Commonwealth of Puerto Rico is running out of land-based sand and gravel resources and is moving towards a crisis situation for construction aggregate supplies. Island officials estimated that land-based deposits will be exhausted by the year 2000 (People, Land, and Water, 1997-98).

The Commonwealth is currently permitting sand and gravel extraction from coastal sand dunes and parts of beaches. Alternative sources include dredging offshore deposits, manufacturing sand from crushed rock, and importing aggregates from other islands.

Because of MMS's offshore mineral expertise, the Puerto Rico Department of Natural and Environmental Resources (DNER) officially requested that the Service review the island's sand and gravel supply situation, assess the feasibility of developing the island's offshore sand resources for construction aggregate materials, and recommend environmental studies to assess potential adverse impacts on the environment should the Commonwealth decide to proceed with offshore mineral development.

MMS subsequently prepared a report which details recommendations on how best to proceed with leasing and development of three of the island's largest offshore sand deposits. The report focused on physical oceanographic and biologic studies needed to assess the environmental consequences associated with the mining of the deposits, including cost estimates and length of time to complete.

The costs of such studies would be borne by the Government of Puerto Rico. However, MMS expressed its willingness to serve as a consultant to the island's DNER and to help in contracting for the recommended studies. Commonwealth officials are currently reviewing the MMS report and evaluating the options for mining the island's offshore sand and gravel deposits.

Metals have not been mined in Puerto Rico since the Juncos iron mine closed in 1953; prospects for resuming metal mining in the near future do not appear to be likely. However, as noted in a publication of the former U.S. Bureau of Mines regarding the Commonwealth of Puerto Rico, metal occurrences are common on the island and the possibility of future development of an economic metal deposit should not be completely discounted.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity. All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. Crushed stone and portland cement estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html . All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]While a memorandum of understanding (MOU) was officially made between the U.S. Geological Survey (USGS) and the Commonwealth of Puerto Rico, MOU's were not established with the Commonwealth of the Northern Mariana Islands, U.S. Caribbean and Pacific Island Possessions, or the U.S. Trust Territory of the Pacific Islands. Nevertheless, data on nonfuel mineral production were reported to the USGS for the islands of American Samoa and Guam of the Pacific Island Possessions. These data appear in table 1.

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Sikich, S. W., and Alonso, R. M., 1993, The Mineral Industries of Puerto Rico, Northern Marianas, Island Possessions, and Trust Territory: U. S. Bureau of Mines Minerals Yearbook 1992, v. 2, p. 467-468 and 470.

People, Land, and Water, 1997, Working With America: Evaluating Puerto Rico's Sand and Gravel Resources, The U.S. Department of the Interior, December 1997-January 1998, p. 25.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN THE COMMONWEALTH OF PUERTO RICO AND ISLANDS ADMINISTERED BY THE UNITED STATES 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Puerto Rico:						
Cement, portland	1,410	W	1,550	W	1,580	W
Lime	23	2,970	38	5,050	38	5,080
Salt	--	--	45	1,500	45	1,500
Stone, crushed	15,300	107,000	13,200	52,500	13,200	52,500
Combined value of clays (common), sand and gravel (industrial), stone (dimension marble), and values indicated by symbol W	XX	146,000	XX	153,000	XX	158,000
Total	XX	256,000	XX	212,000	XX	217,000
Administered Islands:						
American Samoa: Stone, crushed	(3/)	(3/)	--	--	--	--
Guam: Stone, crushed	2,060	17,400	1,660	13,800	1,600	13,800
Total 4/	XX	17,400	XX	13,800	XX	13,800

p/ Preliminary. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Withheld to avoid disclosing company proprietary data.
4/ Total does not include values of items withheld.

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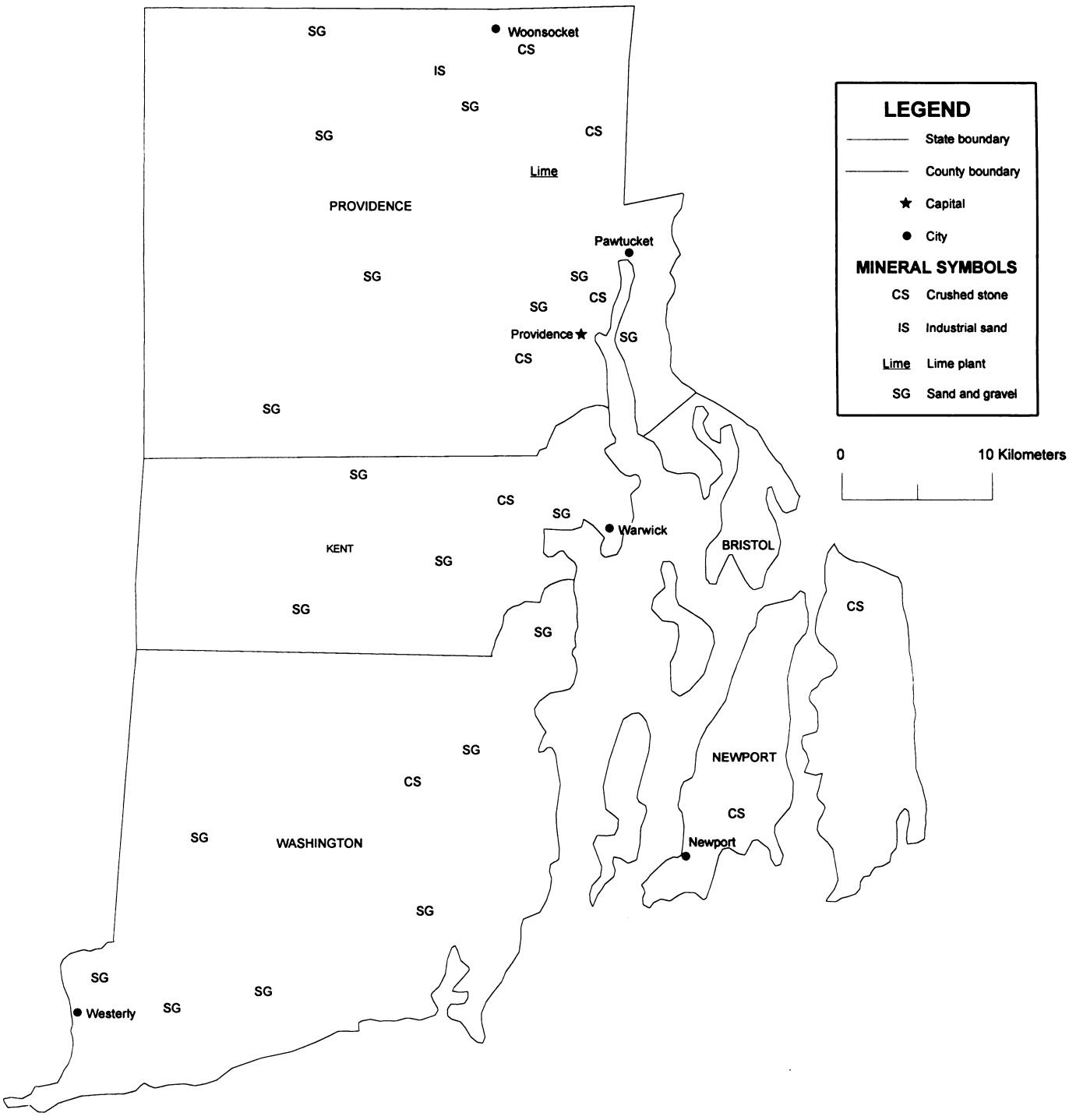
RHODE ISLAND



Source: Rhode Island Department of Environmental Management/U.S. Geological Survey

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THE MINERAL INDUSTRY OF RHODE ISLAND

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the University of Rhode Island Department of Geology, Office of the State Geologist, for collecting information on all nonfuel minerals.

In 1997, for the third consecutive year, Rhode Island ranked 49th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997, $22.6 million, was virtually the same as that of 1996. This followed a 25% decrease in value from 1995 to 1996 (based on final 1996 data). The State accounted for about one-tenth of 1% of the total U.S. nonfuel mineral production value. In 1997, only small decreases occurred in the State's nonfuel mineral production and related values (*table 1*). From 1995 to 1996, the decrease in the value of construction sand and gravel, Rhode Island's leading nonfuel mineral commodity, accounted for the State's drop in value. Industrial sand and gravel was produced in the State, but the data have been withheld from table 1 to avoid disclosing company proprietary data.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. Construction sand and gravel and crushed stone estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN RHODE ISLAND 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Gemstones	NA	1	NA	1	NA	1
Sand and gravel, construction	2,790	21,500	1,990	13,300	1,910	13,100
Stone, crushed	1,250	9,140	1,440	9,680	1,400	9,500
Total 3/	XX	30,700	XX	23,000	XX	22,600

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Partial total, excludes values which must be concealed to avoid disclosing company proprietary data.

TABLE 2
RHODE ISLAND: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	2	W	W	$9.75	1	W	W	$11.87
Granite	5 r/	887 r/	$6,040 r/	6.81 r/	5	948	$6,680	7.05
Traprock	2	W	W	8.41	2	W	W	6.04
Total	XX	1,250	9,140	7.30	XX	1,440	9,680	6.74

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits except unit values; may not add to totals shown.

TABLE 3
RHODE ISLAND: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/ 3/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Construction aggregates 4/	395	$3,490	$8.83
Unspecified: 5/			
Actual	363	2,190	6.04
Estimated	679	4,000	5.89
Total	1,440	9,680	6.74

1/ District tables were not produced for 1996 to avoid disclosing company proprietary data.
2/ Includes granite, limestone, and traprock.
3/ Data are rounded to three significant digits; may not add to totals shown.
4/ Includes agricultural limestone, bituminous aggregate (coarse), concrete aggregate (coarse), crusher run or fill or waste, filter stone, other coarse aggregate, other fine aggregate, other graded coarse aggregate, other specified uses not listed, riprap and jetty stone, stone sand (concrete), and stone sand (bituminous mix or seal).
5/ Includes production reported without a breakdown by end use and with estimates for non-respondents.

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TABLE 4
RHODE ISLAND: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	147	$1,160	$7.88
Plaster and gunite sands	W	W	10.00
Asphaltic concrete aggregates and other bituminous mixtures	157	1,090	6.95
Road base and coverings	93	728	7.83
Fill	59	357	6.05
Snow and ice control	42	432	10.29
Railroad ballast	W	W	17.00
Unspecified 3/	1,480	9,450	6.37
Total or average	1,990	13,300	6.68

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ To avoid disclosing company proprietary data, no district tables were produced in 1996.
2/ Data are rounded to three significant digits, except value per ton; may not add to totals shown.
3/ Includes estimates for nonrespondents.

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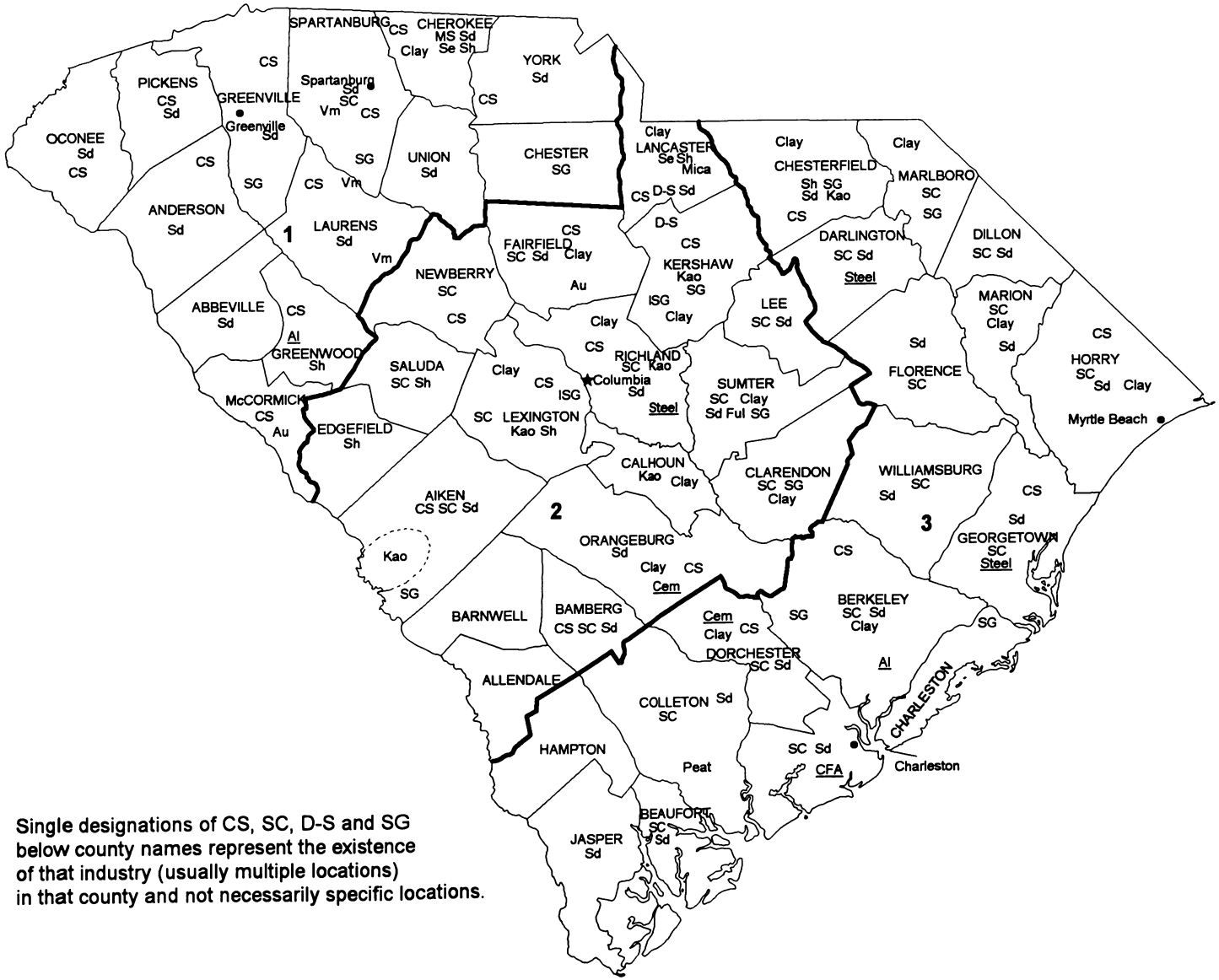
SOUTH CAROLINA



Single designations of CS, SC, D-S and SG below county names represent the existence of that industry (usually multiple locations) in that county and not necessarily specific locations.

LEGEND

- State boundary
- County boundary
- ★ Capital
- ● City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Al	Aluminum plant
Au	Gold
Cem	Cement plant
CFA	Chrome ferroalloy plant
Clay	Clay
CS	Crushed stone
D-S	Dimension stone
Ful	Fuller's earth
ISG	Industrial sand and gravel
Kao	Kaolin
Mica	Mica
MS	Manganese schist
Peat	Peat
SC	Sand and clay
Sd	Sand
Se	Sericite
SG	Sand and gravel
Sh	Shale
Steel	Iron and steel plant
Vm	Vermiculite

Concentration of mineral operations

0 — 40 Kilometers

Source: South Carolina Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF SOUTH CAROLINA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the South Carolina Geological Survey for collecting information on all nonfuel minerals.

South Carolina ranked 27th in the Nation in total nonfuel mineral production value[1] in 1997, according to the U.S. Geological Survey (USGS). The State was 26th in 1996. The estimated value for 1997 was $507 million, a nearly 3% increase from that of 1996. This followed a 10.3% increase from 1995 to 1996 (based on final 1996 data). The State accounted for more than 1% of the U.S. total nonfuel mineral production value.

In 1997, most nonfuel mineral commodities increased in value, led by a 6% rise of $9 million in the value of crushed stone and a nearly 4%, $7 million increase in portland cement (*table 1*). Vermiculite, crude mica, and silver dropped slightly, and dimension granite and gemstones virtually remained the same. Only gold, dropping by about 16%, showed any significant decrease. In 1996, most of the State's increase was accounted for by a $30 million increase in the value of portland cement and a $14 million rise in crushed stone (*table 1*).

Based on USGS estimates of the quantities produced in the 50 States in 1997, South Carolina remained first of 2 States that produced vermiculite and fourth in masonry cement. The State rose to 6th from 8th in the production of common clays and dropped from 2d to 3d in kaolin, from 4th to 5th in crude mica, and from 9th to 10th of the 13 gold-producing States. Additionally, significant quantities of portland cement, crushed stone, and industrial sand and gravel were produced in South Carolina. Primary aluminum and raw steel also were produced in the State, but from raw materials that were acquired from other domestic and foreign sources. South Carolina remained seventh of 14 States in the production of primary aluminum in 1997.

The following narrative information was provided by the South Carolina Geological Survey.[2] The Brewer Gold Co. neared the final stages of reclaiming its Brewer Gold Mine in Chesterfield County. Brewer mined and processed gold ore from 1987 to 1993. The Brewer Mine was an open pit mining operation that used cyanide heap leach to extract gold. While extracting and processing about 5,540 kilograms of gold, approximately 93 hectares of land was disturbed by an open pit, leach pads, and process facilities.

About 73 hectares were affected directly by the location of heap leach pads, waste rock dump, and the open pit. The original reclamation plan called for the open pit to be reclaimed as a deepwater lake and the leach pads and waste rock dumps to be encapsulated in clay upon final reclamation. However, Brewer changed its plans based on the amount of rock with acid generation potential encountered during mining and the poor water quality that the company anticipated would accumulate in the open pit after mining. The conceptual reclamation plan for the mine and facilities evolved during the final stages of mining to consider backfilling the open pit with mine waste. Backfilling the open pit with the leach pad waste and waste rock would reduce the land directly affected by the mine facilities from 93 hectares to approximately 20 hectares. This also would provide a better method to prevent the oxidation of sulfide minerals and the minimization of long term maintenance of the reclaimed site during and after closure.

The final decision to backfill the open pit was made in 1994, and following review and approval of the revised reclamation and closure plan, final reclamation activities began in 1995. The pit backfill involved the selective placement of about 5.1 million cubic meters of mine waste that was placed according to its potential for acid generation. Mine waste that had been leached with cyanide solutions were first rinsed to lower and acceptable levels of toxicity. Mine waste with acid generation potential was either placed below the anticipated groundwater level (limited oxygen in the reducing environment would prevent oxidation of the sulfide minerals) or well above the anticipated water level in the backfilled pit (limiting moisture and thereby limiting oxidation). Oxidized mine waste with neutralizing potential was placed at the zone where the water table would ultimately rise. The backfilled pit was capped with approximately 186,000 square meters of geosynthetic clay liner (GCL). The GCL was covered with about 1 meter of low permeability soil and topped with soil for vegetation.

With planned completion of the earth moving phase and capping of the backfilled pit during 1998, final closure activities for the Brewer Gold Mine site will be about 90% complete. Remaining reclamation work will involve the final design on the water treatment facility to treat groundwater outflow from the backfilled pit, closure of the existing water treatment facility, establishment of a stable vegetative growth to protect the backfilled pit's clay cap, and the continued establishment maintenance of vegetative growth throughout the remaining 73 hectares.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internetat http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Craig Kennedy, Geologist with the South Carolina Geological Survey, authored the text of State minerals information submitted by that agency.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN SOUTH CAROLINA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement:						
Masonry	W	W	286	27,100 e/	292	28,200 e/
Portland	2,210	156,000	2,370	186,000 e/	2,420	193,000 e/
Clays:						
Common	1,220	4,910	1,260	4,860	1,350	5,550
Fire	24	W	24	W	–	–
Kaolin	373	16,800	387	18,100	306	20,600
Gemstones	NA	W	NA	16	NA	16
Peat	W	W	–	–	3	10
Sand and gravel:						
Construction	8,880	29,000	8,780	29,000	9,000	30,500
Industrial	839	20,500	761	19,500	799	19,600
Stone, crushed	22,000	132,000	23,800	146,000	24,600	155,000
Combined value of gold, manganiferous ore (1995), mica (crude), silver, stone (dimension granite), vermiculite, and values indicated by symbol W	XX	88,700	XX	62,700	XX	54,300
Total	XX	447,000	XX	493,000	XX	507,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
SOUTH CAROLINA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	9	3,140	$14,000	$4.44	7	3,740	$18,300	$4.88
Calcareous marl	2	W	W	2.64	2	W	W	2.90
Granite	23	16,600	109,000	6.57	24	17,700	119,000	6.71
Marble	1	W	W	6.65	1	W	W	6.79
Total	XX	22,000	132,000	5.98	XX	23,800	146,000	6.15

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 3
SOUTH CAROLINA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE 1/ 2/ 3/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch) 4/	323	$3,020	$9.34
Coarse aggregate, graded 5/	3,440	26,600	7.75
Fine aggregate (-3/8 inch) 6/	1,300	5,910	4.54
Coarse and fine aggregates:			
Graded road base or subbase	1,020	5,420	5.33
Crusher run or fill or waste	1,900	10,900	5.72
Other coarse and fine aggregates	45	331	7.36
Chemical and metallurgical, cement manufacture	W	W	2.84
Unspecified: 7/			
Actual	14,600	90,100	6.16
Estimated	W	W	5.74
Total	23,800	146,000	6.15

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ To avoid disclosing company proprietary data; "District tables were not produced for 1996."
2/ Includes calcareous marl, granite, limestone, and marble.
3/ Data are rounded to three significant digits; may not add to totals shown.
4/ Includes filter stone, macadam, and riprap and jetty stone.
5/ Includes bituminous aggregate (coarse), bituminous surface treatment aggregate, concrete aggregate (coarse), other graded coarse aggregate, and railroad ballast.
6/ Includes screening (undesignated), stone sand (bituminous mix or seal) and stone sand (concrete).
7/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 4
SOUTH CAROLINA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996, BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	3,460	$13,100	$3.78
Concrete products (blocks, bricks, pipe, decorative, etc.)	249	606	2.43
Asphaltic concrete aggregates and other bituminous mixtures	165	664	4.02
Road base and coverings	82	204	2.49
Fill	764	1,260	1.65
Snow and ice control	18	100	5.56
Other miscellaneous uses	86	356	4.14
Unspecified: 2/			
Actual	1,730	5,950	3.44
Estimated	2,230	6,820	3.06
Total or average	8,780	29,000	3.31

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 5
SOUTH CAROLINA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products	132	590	2,140	7,540	1,430	5,530
Asphaltic concrete aggregates and road base and coverings 2/	198	901	513	816	317	509
Other miscellaneous uses	–	–	–	–	86	356
Unspecified: 3/						
Actual	–	--	162	540	1,570	5,410
Estimated	197	903	520	1,260	1,510	4,660
Total	527	2,390	3,340	10,200	4,910	16,500

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes fill, and snow and ice control.
3/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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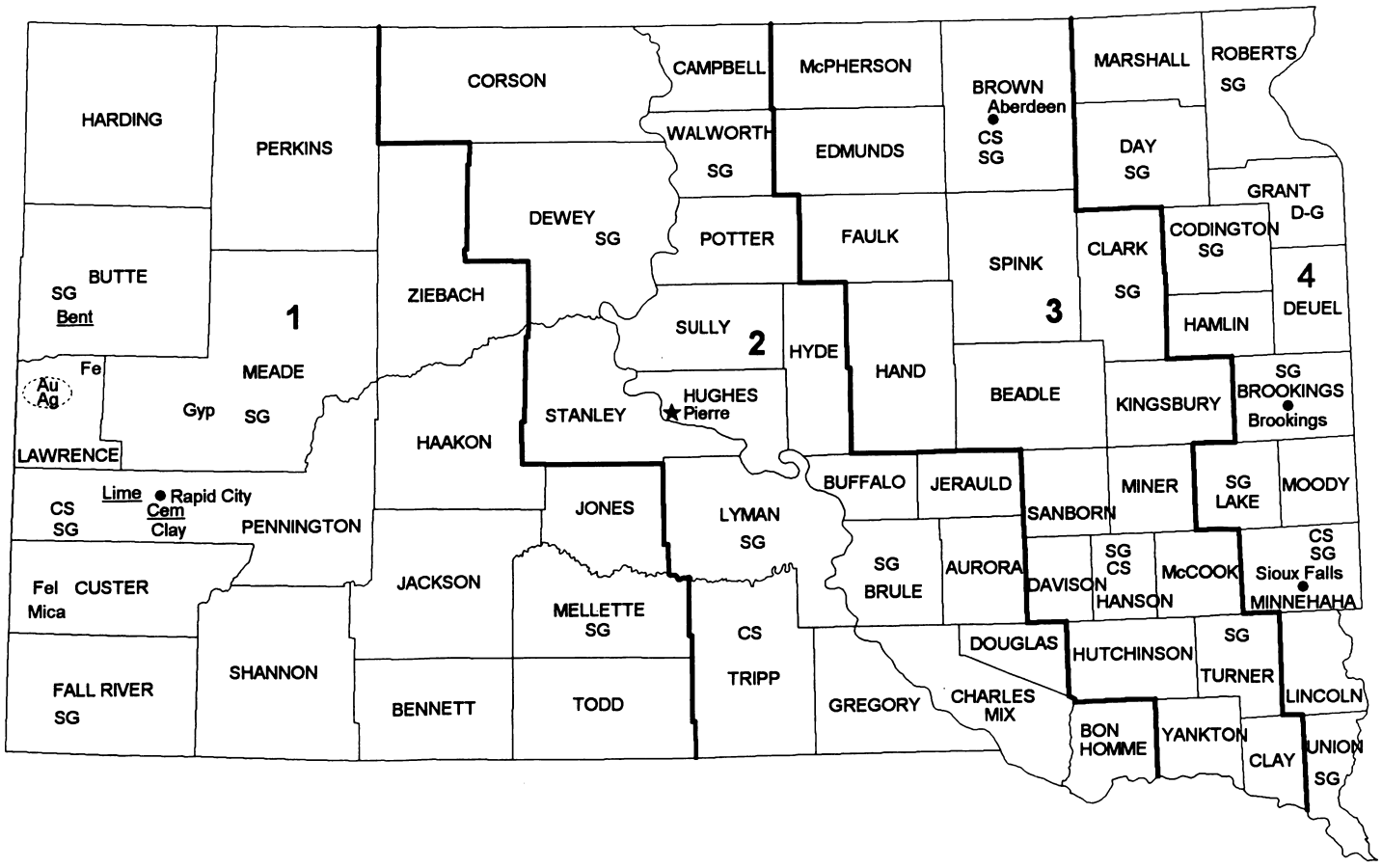
SOUTH DAKOTA



LEGEND

- State boundary
- County boundary
- ★ Capital
- ● City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Ag	Silver
Au	Gold
Bent	Bentonite mill
Cem	Cement plant
Clay	Clay
CS	Crushed stone
D-G	Dimension granite
Fe	Iron
Fel	Feldspar
Gyp	Gypsum
Lime	Lime plant
Mica	Mica
SG	Sand and gravel
	Concentration of mineral operations

0 50 Kilometers

Source: South Dakota Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF SOUTH DAKOTA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the South Dakota Geological Survey for collecting information on all nonfuel minerals.

South Dakota ranked 36th in the Nation in 1997 in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The State was 35th in 1996. The estimated value for 1997 was $339 million, a 5% decrease from that of 1996. This followed a 7.5% increase from 1995 to 1996 (based on final 1996 data). The State accounted for almost 1% of the U.S. total nonfuel mineral production value.

Gold remained South Dakota's leading nonfuel mineral by value; the quantity and value have been withheld for 1996 and 1997 to avoid disclosing company proprietary data. In 1997, the combined increased values of crushed stone, portland cement, and construction sand and gravel (in descending order of increase) were significantly less than the decrease in the value of gold, resulting in a net decrease for the year. Most other mineral commodities showed small increases in value or virtually remained the same except for crude gypsum and silver, which had small decreases. In 1996, increases in lime, portland cement, gold, and crushed stone accounted for most of the increased value. All other minerals had small increases except masonry cement and feldspar which decreased.

Based on USGS estimates of the quantities produced in the 50 States during 1997, South Dakota remained fourth in gold, seventh in feldspar, and eighth in dimension stone. The State dropped from third to fourth in the production of crude mica.

The following narrative information was provided by the South Dakota Geological Survey[2] (SDGS) of the State's Department of Environment and Natural Resources (DENR). According to information gathered by the SDGS, the gold mines in the northern Black Hills produced 16.4 metric tons of gold in 1997, about 6% less than that of 1996. The average price of gold in 1997 was $331.29 per troy ounce, yielding a gross value of about $175 million. While the amount of gold produced in 1997 dropped by only about 6% from that of the previous year, the lower gold price equated to a 19% drop in gross value.

Wharf Resources Ltd. completed its State mine permit application for its proposed Clinton Project. The Clinton Project is a 21.1-ton-per-year gold project with an average grade of 1.1 grams per ton, yielding 19 million tons of ore and 50 million tons of waste. It is scheduled for a hearing in front of the South Dakota Board of Minerals and Environment in May 1998. If approved, the project will continue production at Wharf's mine through 2007. Ore from the Clinton Project would be processed at Wharf's existing heap leach facility, which has operated in South Dakota since 1982.

During the 1997 reporting period, 426 companies had active mine licenses for nonmetallic industrial minerals in South Dakota. An operator must obtain a license to mine for sand, gravel, pegmatite minerals, materials used in the process of making cement or lime, and rock to be crushed and used in construction. There was also a total of 52 mine permits that covered the mining of other nonmetallic minerals such as slate, bentonite, and dimension stone.

Sand and gravel was the major nonmetallic industrial mineral commodity produced, with 12.1 million tons reportedly removed. Sand and gravel is produced in nearly every county in South Dakota and is used mainly for road construction projects. Sioux quartzite was the next largest nonmetallic industrial mineral commodity produced, with 2 million tons reported removed. It is quarried from four locations in southeastern South Dakota. Most of the quartzite is crushed and used in construction. Some larger blocks are used for riprap, railroad ballast, and occasionally for decorative purposes. Pegmatite mining, mainly in the southern Black Hills, produced 7,060 tons of pegmatite minerals such as feldspar, mica, and rose quartz. The South Dakota Cement Plant reported mining 1.1 million tons of limestone, 182,000 tons of shale, 50,900 tons of gypsum, and 63,700 tons of sand. A total of 235,000 tons of granite was mined by Dakota Granite Co. and Cold Spring Granite Co. from quarries near Milbank, SD. Because of its beauty and distinctive red color, the mahogany granite is used primarily for floor tiles, monuments, and building construction. Much of it goes to international markets. Total sales from 1997 production were $35.2 million. There was 62,000 tons of bentonite mined in the western portion of South Dakota.

Four exploration permits were issued in 1997 to Wharf Resources, Homestake Mining Co., Brohm Mining Corp., and Naneco Minerals Inc. Exploration was primarily for gold and silver. A total of 2,157 test holes were permitted for drilling in Lawrence and Permington Counties; a three-fold increase over the number of exploration drill holes permitted in 1996. The majority of holes will be drilled to depths less than 760 meters, and a few diamond core holes may be drilled to depths of up to 4,600 meters.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals.

[2]T.V. Durkin, E.H. Holm, and D.K. Burtts of the Minerals and Mining Program, South Dakota Department of Environment and Natural Resources, jointly authored the text of mineral industry information.

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Approximately 13 kilometers of new roads were permitted to access drill sites.

The DENR issued three notices of violation to two large-scale gold mines in 1997. Brohm Mining was issued two notices of violation for two separate releases of acidic water into Strawberry and Bear Butte Creeks. In settlement of these violations, Brohm has paid penalties and agreed to take steps to prevent future acid water discharges. Wharf Resources was issued one notice of violation for exceeding nitrate ground water quality standards and cyanide surface water quality standards. While the cyanide levels exceeded the limit in their permit, they were considered nontoxic to the environment. In settlement of the notice, Wharf agreed to pay a penalty of $40,000 and give the Department of Game, Fish, and Parks $160,000 over the next 3 years for stream improvement projects in the northern Black Hills. In addition, Wharf agreed to and has constructed a biological treatment plant to reduce nitrate concentrations at the mine to acceptable levels. Preliminary analyses have shown that the nitrate treatment plant is very effective at removing nitrate from mine waters.

The large-scale gold mines were successful in reclaiming 200 hectares of mining disturbed land that was required by law to be completed by September 1, 1997. In fact, the gold mines reclaimed about 251 hectares of mining disturbed land by July, 2 months before the September deadline. The South Dakota Board of Minerals and Environment held a 3-day public hearing in July, which included tours of the reclaimed areas. The purpose of the public hearing was to review the effectiveness of State mine reclamation standards. The board, on a unanimous vote, found that the current reclamation standards are adequate and no additional requirements were needed. The board commended the large-scale gold mines for their hard work and dedication to successful reclamation.

The pit impoundment at LAC Minerals Ltd.'s Richmond Hill Mine, designed to reclaim impacts from acid rock drainage that took place at the site in 1992, continued to perform exceptionally well based on results of extensive post-closure performance monitoring of the facility. Relocation and capping of reactive sulfide wastes provides the added benefit of avoiding the need for long-term active water treatment. The site will require a minor amount of maintenance and routine post-closure monitoring.

The DENR completed an inventory of inactive and abandoned mines in the Black Hills. Approximately 900 historic minesites were identified, of which about 200 are located on U.S. Forest Service land and 700 on private land. A final report, an electronic database of abandoned mine information, and maps of the site locations are available by calling 605-773-4201. The electronic database is downloadable from the DENR's Minerals and Mining Program web page at http://www.state.sd.us/denr/des/mining/mineprg.htm.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN SOUTH DAKOTA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995		1996		1997 p/	
		Quantity	Value	Quantity	Value	Quantity	Value
Clay, common		136	W	147	W	147	W
Gemstones		NA	173	NA	98	NA	93
Gold 3/	kilograms	17,100	214,000	W	W	W	W
Gypsum, crude		--	--	W	W	44	312
Sand and gravel, construction		8,730	26,200	8,750	27,700	8,940	29,000
Silver 3/	metric tons	4	668	5	816	5	714
Stone, crushed		5,420 4/	25,700 4/	5,640	28,700	7,000	36,000
Combined value of cement, feldspar, iron ore (usable), lime, mica (crude), stone [crushed granite and miscellaneous (1995), dimension granite], and values indicated by symbol W		XX	65,300	XX	300,000	XX	273,000
Total		XX	332,000	XX	357,000	XX	339,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Recoverable content of ores, etc.
4/ Excludes certain stones; kind and value included with "Combined value" data.

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TABLE 2
SOUTH DAKOTA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone	4	2,680	$9,550	$3.56	4	2,850	$11,500	$4.05
Granite	(2/)	(2/)	(2/)	(2/)	1	1	7	7.00
Quartzite	6	2,740	16,200	5.90	7	2,790	17,200	6.16
Miscellaneous stone	(2/)	(2/)	(2/)	(2/)	--	--	--	--
Total	XX	5,420	25,700	4.74	XX	5,640	28,700	5.09

XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excludes granite and miscellaneous stone from State total to avoid disclosing company proprietary data.

TABLE 3
SOUTH DAKOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/ 3/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch), riprap and jetty stone 4/	215	$1,350	$6.28
Coarse aggregate, graded:			
Concrete aggregate, coarse	480	2,670	5.55
Bituminous aggregate, coarse	200	874	4.37
Bituminous surface-treatment aggregate	137	709	5.18
Coarse and fine aggregates:			
Graded roadbase or subbase	296	1,450	4.90
Crusher run or fill or waste	23	113	4.91
Other construction materials 5/	288	1,140	3.97
Chemical and metallurgical:			
Cement manufacture	982	1,790	1.82
Lime manufacture	W	W	4.52
Glass manufacture	W	W	25.00
Unspecified: 6/			
Actual	2,020	13,100	6.47
Estimated	783	4,570	5.83
Total	5,640	28,700	5.09

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ To avoid disclosing company proprietary data, no district tables were produced for 1996.
2/ Includes limestone, quartzite, and granite.
3/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
4/ Includes filter stone and other coarse aggregate.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
SOUTH DAKOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products 2/	1,040	$5,170	$4.96
Asphaltic concrete aggregates and other bituminous mixtures	511	2,310	4.52
Road base and coverings	2,640	6,600	2.50
Fill	498	960	1.93
Snow and ice control	21	53	2.52
Other miscellaneous uses	123	204	1.66
Unspecified: 3/			
Actual	834	3,250	3.89
Estimated	3,090	9,150	2.96
Total or average	8,750	27,700	3.16

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
SOUTH DAKOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	354	1,760	W	W
Asphaltic concrete aggregates and road base materials 3/	882	1,840	W	W
Other miscellaneous uses	–	--	1,000	3,000
Unspecified: 4/				
Actual	43	175	47	79
Estimated	527	1,640	695	1,920
Total	1,810	5,410	1,750	5,000
	District 3		District 4	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	W	W	316	1,490
Asphaltic concrete aggregates and road base materials 3/	W	W	1,330	4,080
Other miscellaneous uses	948	3,130	–	--
Unspecified: 4/				
Actual	132	294	611	2,700
Estimated	481	1,360	1,390	4,220
Total	1,560	4,790	3,640	12,500

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill and snow and ice control.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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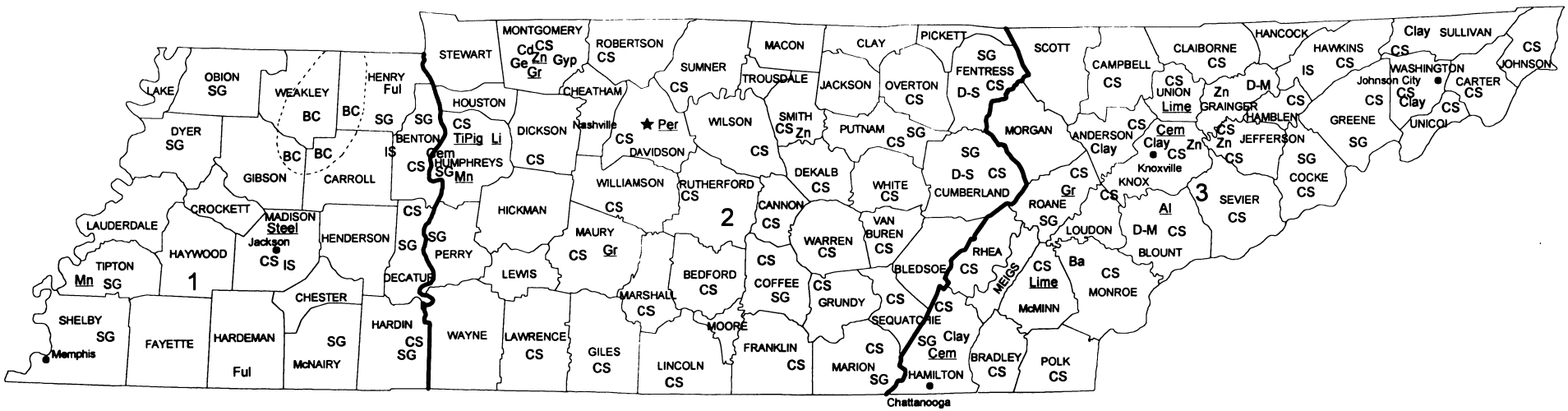
TENNESSEE



LEGEND

- State boundary
- County boundary
- ★ Capital
- ● City
- 1 ——— Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Al	Aluminum plant	CS	Crushed stone	Gyp	By-product gypsum	SG	Sand and gravel
Ba	Barite	D-M	Dimension marble	IS	Industrial sand	Steel	Steel plant
BC	Ball clay	D-S	Dimension sandstone	Li	Lithium plant	TiPig	Titanium dioxide pigment plant
Cem	Cement plant	Ful	Fuller's earth	Lime	Lime plant	Zn	Zinc
Clay	Clay	Gem	Freshwater pearls and shells	Mn	Manganese dioxide plant	Zn	Zinc refinery (Cd by-product cadmium) (Ge by-product germanium)
		Gr	Graphite plant	Per	Perlite plant		

Concentration of mineral operations

0 50 Kilometers

Source: Tennessee Division of Geology/U.S. Geological Survey

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THE MINERAL INDUSTRY OF TENNESSEE

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Tennessee Division of Geology for collecting information on all nonfuel minerals.

In 1997, Tennessee ranked 19th for the sixth time in the past 7 years among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was more than $786 million, a 19% increase from that of 1996. This followed a marginal decrease from 1995 to 1996 (based on final 1996 data). The State accounted for about 2% of the U.S. total nonfuel mineral production value.

Crushed stone has been Tennessee's leading mineral commodity, by value, for more than 25 years, except for 1981 when zinc was first. In 1997, crushed stone accounted for about 43% of the State's total nonfuel mineral production value. The State's increase in value in 1997 mostly resulted from a substantial increase in the value of zinc and a smaller gain in that of crushed stone (*table 1*). Portland cement, ball clay, and construction sand and gravel values also rose and contributed to Tennessee's significant gain for the year. (All listings are in descending order of relative change.) The only nonfuel mineral commodities to show any significant decrease were those of gemstones and kaolin, all others virtually remained the same. In 1996, the increased values of crushed stone, portland cement, lime, and kaolin when combined were slightly less than the decreases that occurred in zinc, gemstones, construction sand and gravel, and fuller's earth. This resulted in the State's small net decrease for the year. All other changes were smaller and inconsequential to the net result.

Compared with USGS estimates of the quantities produced in the 50 States in 1997, Tennessee remained the leading gemstone- and ball clay-producing State, 2d in zinc, 4th in barite, 7th in fuller's earth, and 11th in crushed stone. Additionally, the State's minerals industry produced significant quantities of industrial sand and gravel and common clays. Primary aluminum and raw steel were produced in Tennessee but were processed from materials obtained from other domestic and foreign sources. The State ranked 12th in the production of primary aluminum.

The following narrative information was provided by the Tennessee Division of Geology.[2] Tennessee's zinc mining industry had another active year, although zinc production was down from that of 1996. Savage Zinc Co., a U.S. subsidiary of Savage Resources Ltd. (Australia), continued operation of the Elmwood-Cumberland-Gordonsville mining and milling operations in middle Tennessee and its electrolytic refinery at Clarksville. Savage continued operation of the Clinch Valley Mine in east Tennessee. ASARCO Incorporated continued operation of the Coy, Immel, and Young Mines in the Mascot-Jefferson City zinc district in east Tennessee. Its New Market Mine remained closed (the mine was closed in September 1996).

In the Coker Creek gold district of Monroe County in southeast Tennessee, the East Coast Prospector's Club dropped one of its two leases on land where the club members mine placer gold using portable dredges, sluices, and pans. Coker Creek Village operates a pan-for-fee operation for naturally occurring gold. Village personnel report that the number of recreational gold panners and tourists who pan for gold was up from 1996. Although the amount of gold recovered is very small relative to other gold districts in the United States, it continues to have a positive effect on the local tourist economy.

In the aggregate industry, Tennessee's crushed stone producers included American Limestone Co., a subsidiary of Asarco, Cornerstone Construction and Materials, Inc. (The Stone Man, Inc., etc.), the Rogers Group, Inc., and Vulcan Materials Co. Sand and gravel was dredged from the Tennessee River in the western part of the State by the following companies: Nick's Silica Co., SanGravl Co., Teague Brothers Sand and Gravel Inc., Tinker Sand and Gravel Inc., and Vulcan Materials Co. Nick's Silica Co. mostly produced industrial sand and gravel. The major sand and gravel producers in east Tennessee included the Nolichucky Sand Co., in Greene County, and the Newport Sand and Gravel Co., in Cocke County. Both companies crushed rock from alluvial deposits consisting chiefly of quartzites and sandstones.

High-calcium limestone was produced by the Franklin Limestone Co. (underground) at Crab Orchard in Cumberland County and Global Stone (formerly Tennessee Luttrell; open pit and underground) at Luttrell in Union County.

Tennessee's clay industry was also very active in 1997. General Shale mined clay and shale to supply its brick plants at Chattanooga, Johnson City, and Knoxville. Four companies mined and processed ball clay in west Tennessee as follows: H.C. Spinks Co., Kentucky-Tennessee Clay Co., Old Hickory Clay Co., and United Clays, Inc.

High-silica sand, used chiefly by the glass industry, was mined

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Robin C. Hale, Chief Geologist (Knoxville), authored the text of mineral industry information submitted by the Tennessee Division of Geology.

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subsidiary of Little Six Corp. (a Virginia-based coal company), and in west Tennessee by Unimin. Unimin operates the former Morie Mine and plant as Tennessee Silica. Short Mountain Silica is a major regional producer of high-silica sand, much of its production going to American Float Glass at Surgoinsville in Hawkins County (eastern Tennessee) for the production of window glass. Short Mountain also produces concrete, mortar, filter sand, golf course sand, and silica flour. They do not produce road aggregate because their material does not meet State specifications.

Dimension marble was produced in east Tennessee by the Imperial Black Marble Co. at Thorn Hill in Union County. In addition to producing finished stone from blocks of marble that were quarried by previous operators, the Tennessee Marble Co. renewed quarrying activities on its property. Tile and dimension stone were produced at its Friendsville plant in Blount County. Quartzitic sandstone was produced on the Cumberland Plateau. Products included dimension stone, field stone, rough broken stone, ashlar, flagstone, and rubble. Although there are a number of individuals who independently quarry the sandstone, the three companies that quarried, sawed, and fabricated sandstone were the Cumberland Mountain Stone Co., the Silvara Stone Co., and the Tennessee Building Stone, Inc.

Three companies collected mollusk shells from the Tennessee River in the western part of the State for the pearl industry (chiefly Japan). These companies were Tennessee Shell Co., American Shell, and U.S. Shell. The American Pearl Co. produced pearls only.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN TENNESSEE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Ball	663	29,000	679	29,000	695	32,500
Kaolin	1	W	32	W	–	–
Gemstones	NA	16,900	NA	12,900	NA	9,740
Sand and gravel:						
Construction	8,020	36,700	8,380	35,300	9,790	42,300
Industrial	918	14,700	747	13,900	721	13,400
Stone, crushed	52,600	286,000	55,100	305,000	60,000	336,000
Combined value of barite, cement, clays (common, fuller's earth), copper (1995-96), lead, lime, silver (1995-96), stone (dimension marble), zinc, and values indicated by symbol W	XX	282,000	XX	266,000	XX	362,000
Total	XX	665,000	XX	662,000	XX	786,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
TENNESSEE: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	103 r/	46,900 r/	$257,000 r/	$5.47 r/	105	49,500	$275,000	$5.55
Dolomite	10 r/	W	W	5.10 r/	10	W	W	5.44
Granite	1	W	W	4.43	1	W	W	4.54
Sandstone	2	W	W	6.61	2	W	W	6.51
Miscellaneous stone	1	W	W	5.56	1	W	W	5.71
Total	XX	52,600	286,000	5.43	XX	55,100	305,000	5.53

r/ Revised. W Withheld to avoid disclosing proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 3
TENNESSEE: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	1,310	$6,970	$5.33
Filter stone	659	3,470	5.26
Coarse aggregate, graded:			
Concrete aggregate, coarse	3,360	17,700	5.27
Bituminous aggregate, coarse	12,300	69,400	5.63
Bituminous surface-treatment aggregate	1,280	8,120	6.35
Railroad ballast	369	1,800	4.86
Other graded coarse aggregate	687	3,500	5.09
Fine aggregate (-3/8 inch):			
Stone sand, concrete	887	6,720	7.58
Stone sand, bituminous mix or seal	543	3,390	6.24
Screening, undesignated	3,020	17,700	5.84
Coarse and fine aggregates:			
Graded road base or subbase	12,200	63,700	5.20
Unpaved road surfacing	1,000	5,650	5.64
Crusher run or fill or waste	1,860	8,900	4.79
Other construction materials 3/	1,630	8,270	5.09
Agricultural:			
Agricultural limestone	331	2,000	6.03
Poultry grit and mineral food	W	W	11.11
Other agricultural uses	W	W	9.59
Chemical and metallurgical:			
Cement manufacture	W	W	6.79
Lime manufacture	W	W	16.52
Flux stone	W	W	10.57
Sulfur oxide removal	W	W	4.72
Special:			
Mine dusting or acid water treatment	W	W	21.63
Other fillers or extenders	W	W	10.90
Unspecified: 4/			
Actual	4,890	24,000	4.91
Estimated	5,950	27,800	4.67
Total	55,100	305,000	5.53

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, granite, limestone, miscellaneous stone, and sandstone.
2/ Data are rounded to three significant digits, except unit values; may not add to totals shown.
3/ Includes other coarse aggregate, other fine aggregate, other coarse and fine aggregates, macadam, roofing granules, and terrazzo and exposed aggregate.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
TENNESSEE: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 2		District 3	
	Quantity	Value	Quantity	Value
Construction aggregates:				
Coarse aggregate (+1 1/2 inch) 3/	W	W	W	W
Coarse aggregate, graded 4/	9,860	53,500	8,160	47,000
Fine aggregate (-3/8 inch) 5/	W	W	W	W
Coarse and fine aggregate 6/	12,600	62,300	10,600	62,400
Agricultural 7/	(8/)	(8/)	(8/)	(8/)
Chemical and metallurgical 9/	(8/)	(8/)	(8/)	(8/)
Special 10/	(8/)	(8/)	(8/)	(8/)
Unspecified: 11/				
Actual	4,740	23,200	154	862
Estimated	3,220	14,400	2,720	13,400
Total	31,700	163,000	23,400	142,000

W Withheld to avoid disclosing company proprietary data; included with "Coarse and fine aggregate."
1/ Production reported in District 1 was included with "District 2" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), other coarse and fine aggregates, other construction materials, roofing granules and terrazzo and exposed aggregate.
7/ Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes cement manufacture, flux stone, lime manufacture, and sulfur oxide removal.
10/ Includes mine dusting or acid water treatment, and other fillers or extenders.
11/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
TENNESSEE: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 2/	3,050	$14,900	$4.88
Concrete products (blocks, bricks, pipe, decorative, etc.)	277	1,340	4.84
Asphaltic concrete aggregates and other bituminous mixtures	982	4,350	4.42
Road base and coverings 3/	1,910	5,330	2.79
Fill	115	861	7.49
Other miscellaneous uses 4/	63	634	10.06
Unspecified: 5/			
Actual	77	346	4.49
Estimated	1,900	7,580	3.99
Total or average	8,380	35,300	4.21

1/ Data are rounded to three significant digits, except value per ton; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement) and snow and ice control.
4/ Includes filtration and railroad ballast.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
TENNESSEE: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	1,660	6,820	1,670	9,410
Asphaltic concrete aggregates and road base materials 4/	2,210	5,620	802	4,910
Other miscellaneous uses 5/	–	–	63	634
Unspecified: 6/				
Actual	77	346	–	--
Estimated	1,350	4,570	548	3,000
Total	5,300	17,400	3,080	18,000

1/ Production reported in District 3 was included with "District 2" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Includes fill, road and other stabilization (cement), and snow and ice control.
5/ Includes filtration and railroad ballast.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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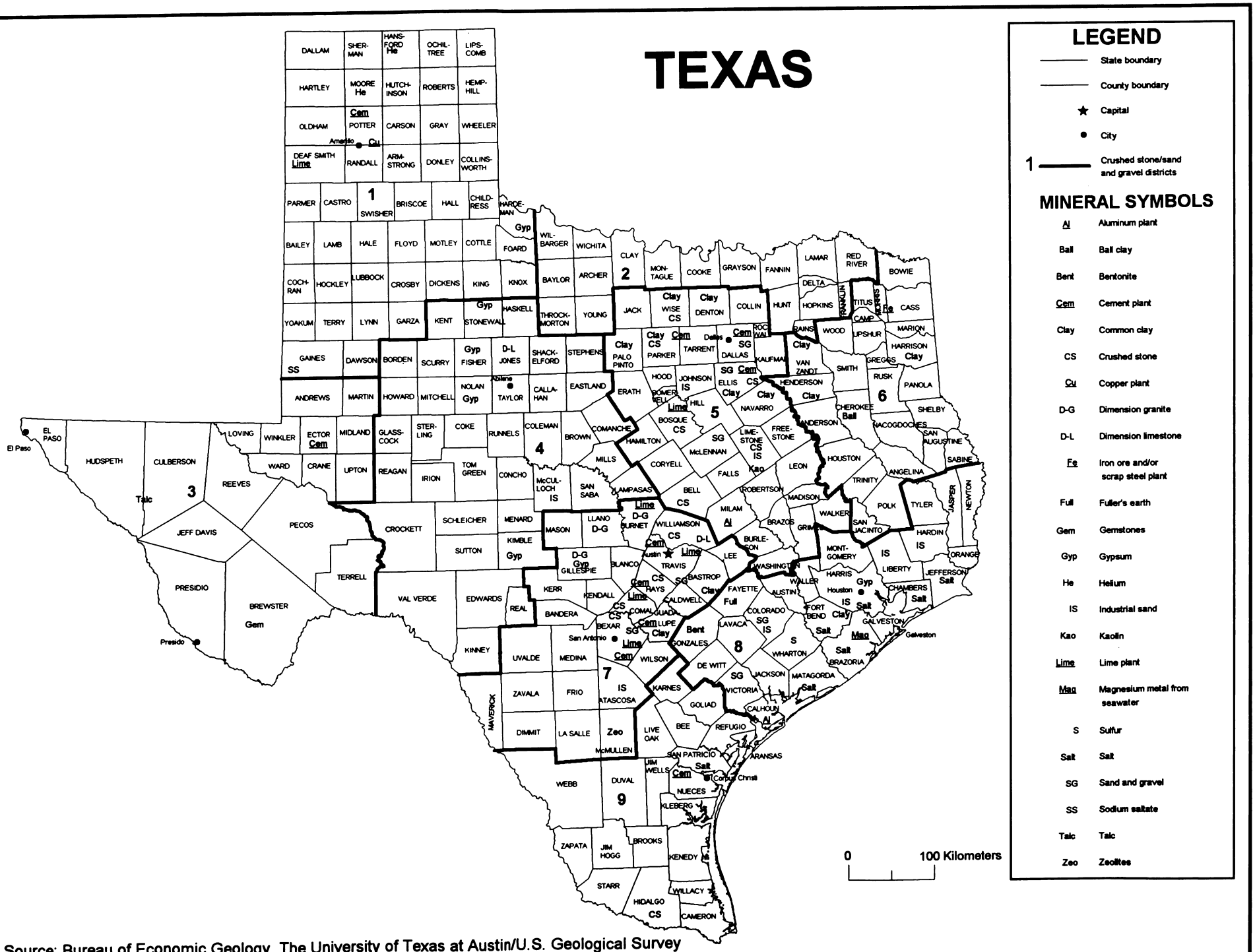

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THE MINERAL INDUSTRY OF TEXAS

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the University of Texas at Austin on behalf of the Texas Bureau of Economic Geology, for collecting information on all nonfuel minerals.

In 1997, for the second consecutive year, Texas ranked seventh in the Nation in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $1.7 billion, a less than 2% decrease from that of 1996. This followed a 3% increase from 1995 to 1996 (based on final 1996 data). The State accounted for nearly 4.5% of the total U.S. nonfuel mineral production value.

Nearly 77% of Texas' nonfuel mineral value came from the mining and processing of the top 5 industrial minerals, in descending order of value: portland cement, crushed stone, construction sand and gravel, salt, and lime. (All the following mineral listings are in descending order of relative change.) In 1997, significant decreases in the values of magnesium metal, construction sand and gravel, and crushed stone together were greater than the combined increased values of portland cement, industrial sand and gravel, ball clay, crude gypsum, common clay, and kaolin, resulting in a net decrease for the State (*table 1*). Smaller increases occurred for masonry cement, lime, talc, gemstones, dimension stone, and crude helium; all other nonfuel minerals showed small decreases in value for the year. In 1996, portland cement and crushed stone value increases contributed the most to Texas' $50 million net increase in total value. Smaller increases in value occurred in dimension stone, construction sand and gravel, salt, and masonry cement; these increases did not balance similar-sized decreases that occurred in magnesium metal, Frasch sulfur, bentonite, crude gypsum, Grade-A helium, industrial sand and gravel, and kaolin. All other changes were smaller and inconsequential to the State's net change in value.

Based on USGS estimates of the quantities of minerals produced in the 50 States in 1997, Texas remained first of 3 magnesium metal-producing States; second in portland cement, crushed stone, salt, crude gypsum, ball clays, talc, and zeolites (this and listings to follow are in descending order of value); and second in each of 2 Frasch sulfur-, 2 sodium sulfate-, and 3 crude helium-producing States. The State continued to rank third in common clays; third of five Grade-A helium-producing States; fifth in dimension stone; sixth in lime and magnesium compounds; and seventh in industrial sand and gravel and masonry cement. Texas dropped from second to third in construction sand and gravel.

Magnesium metal, extracted from seawater, was the only metal produced from the State's natural resources. In addition to the production of magnesium metal, the Texas metal industry produced raw steel, primary aluminum, copper, lead, and smaller amounts of other metals. Sources of plant feed included scrap metal and ores acquired from other domestic or foreign sources. Texas produced an estimated 4.45 million metric tons of raw steel, as reported by the American Iron and Steel Institute. The State ranked eighth in primary aluminum production.

The following narrative information was provided by the Texas Bureau of Economic Geology[2] (BEG). The increase in population and growth in various industries promoted continued activity in the mineral production industries by creating demand for materials used in developing infrastructure. Production of aggregates, dimension stone, and other industrial minerals needed for manufacturing building products responded to changes in construction activity.

Annual job growth in mining, reported by the Texas Labor Market Review, was both strong and relatively stable from March through December 1997. Growth during this period was about 4.0%. Mining created more than 6,300 jobs in 1997 and has created over 9,000 jobs since January 1996, the start of the most recent upturn in job growth.

BEG records show increases in employment in construction and manufacturing related to mineral products during 1997. The construction job annual growth rate was 4.5%. Jobs related to stone, clay, and glass products increased by 2.5% and those related to concrete, gypsum, and plaster products increased by about 3.8% compared with employment figures of 1996.

According to the BEG, Texas producers reported an 8% increase in aggregates production from 1996 to 1997. Construction activity for roads and streets is expected to continue at about the same rate in 1998, but production levels may be reduced slightly to a growth rate of about 5%. However, the approval of a $545 million bond package by the city of Houston for construction and repair of streets, sidewalks, and storm drainage tends to boost the 1998 aggregate industry forecast.

Overall, exploration for nonfuel minerals in Texas showed no significant increase during 1997. However, the BEG received several inquiries regarding possible sources of limestone, sand and gravel materials, industrial sands, and clays.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contact/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]L. Edwin Garner, Research Associate, authored the text of mineral industry information submitted by the Bureau of Economic Geology of the University of Texas at Austin.

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produced in the Yucatan Peninsula (Mexico), started construction of a grinding facility at its aggregate distribution terminal on the Houston Ship Channel. The terminal is located in Green Bayou Industrial Park and is owned by Vulcan Materials Co. of Birmingham, AL, and Empress ICA of Mexico City. The plant will produce high purity micro-sized calcium carbonate filler for use in adhesive, floor coverings, joint compound, paint, and plastics,. Plant production is expected to begin in mid-1998.

Record second quarter gains were reported by Centex Construction Products (CXP). Earnings for the quarter ending on September 30 increased by 37% to a record high of $17.7 million. Revenue for concrete and aggregates increased 16% over 1996 to $11.6 million. The company attributed the increases to a higher volume of concrete and aggregate sales and higher concrete operating margins. The volume of aggregate sales climbed 551,000 metric tons in the second quarter, a 12% increase. The active Texas market and a large contract in northern California contributed to the CXP gains.

U.S. Lime and Minerals, Inc. started work on a $20 million modernization and expansion project for its Texas lime plant in Johnson County. The project includes a new stone crushing and handling system; addition of a preheater to one of the kilns; additional storage, screening, and shipping capacities; and new support facilities.

Overall, activity in the nonfuel mineral industry was above average during 1997. Prospects for continued population increase and commercial development also suggest that production of the State's mineral resources will continue to show strong gains.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN TEXAS 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement:						
Masonry	202	17,600	216	20,300 e/	220	21,100 e/
Portland	8,090	499,000	8,240	532,000 e/	8,400	553,000 e/
Clays:						
Ball	101	2,800	101	W	W	W
Common	2,320	15,500	2,290	15,000	2,240	18,100
Kaolin	36	7,700	28	W	W	W
Gemstones	NA	353	NA	511	NA	932
Gypsum, crude	1,880	16,200	2,240	12,100	2,150	15,400
Helium:						
Crude million cubic meters	5	4,730	W	W	W	W
Grade-A do.	W	W	W	W	14	27,000
Lime	1,370	85,800	1,360	86,300	1,370	87,100
Salt	9,110	85,000	9,700	88,900	9,700	87,700
Sand and gravel:						
Construction	61,100	271,000	61,300	278,000	53,700	249,000
Industrial	1,600	40,300	1,420	38,200	1,590	47,500
Stone:						
Crushed	81,100	310,000	86,500	341,000	81,200	325,000
Dimension metric tons	54,000	13,300	86,600	21,100	87,000	21,200
Talc and pyrophyllite do.	294,000	5,840	225,000	5,100	249,000	5,800
Combined value of clays [bentonite (1995), fuller's earth], magnesium compounds, magnesium metal, sodium sulfate (natural), sulfur (Frasch), and values indicated by symbol W	XX	301,000	XX	293,000	XX	240,000
Total	XX	1,680,000	XX	1,730,000	XX	1,700,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 2
TEXAS: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone	110	76,100	$291,000	$3.82	118	82,500	$323,000	$3.92
Dolomite	1	W	W	2.83	1	W	W	2.95
Marble	20	W	W	W	28	W	W	W
Calcareous marl	2	W	W	2.13	2	W	W	2.27
Granite	1 r/	W	W	W	2	W	W	6.25
Traprock	2	W	W	4.20	2	W	W	6.69
Sandstone	6	1,100	W	W	5	746	W	W
Volcanic cinder	1	W	W	5.39	2	W	W	4.45
Miscellaneous stone	4	986	2,410	2.44	4	703	1,720	2.44
Total	XX	81,100	310,000	3.82	XX	86,500	341,000	3.94

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 3
TEXAS: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	329	$2,340	7.10
Filter stone	200	765	3.83
Other coarse aggregate 3/	666	3,410	5.11
Coarse aggregate, graded:			
Concrete aggregate, coarse	11,300	50,900	4.49
Bituminous aggregate, coarse	8,990	46,500	5.18
Bituminous surface-treatment aggregate	579	3,070	5.30
Railroad ballast	755	3,640	4.82
Other graded coarse aggregate	2,690	12,400	4.62
Fine aggregate (-3/8 inch):			
Stone sand, concrete	2,590	9,250	3.57
Stone sand, bituminous mix or seal	1,860	7,710	4.15
Screening, undesignated	1,590	7,430	4.67
Other fine aggregate	W	W	5.48
Coarse and fine aggregates:			
Graded road base or subbase	21,200	63,800	3.01
Unpaved road surfacing	399	1,670	4.19
Terrazzo and exposed aggregate	W	W	25.63
Crusher run or fill or waste	2,980	7,940	2.66
Other coarse and fine aggregates	2,090	10,700	5.14
Other construction materials 4/	1,550	8,560	5.53
Agricultural:			
Agricultural limestone	262	1,120	4.27
Poultry grit and mineral food	(5/)	(5/)	8.02
Other agricultural uses	(5/)	(5/)	9.35
Chemical and metallurgical:			
Cement manufacture	9,910	23,500	2.38
Lime manufacture	1,080	5,260	4.87
Chemical stone	(5/)	(5/)	4.55
Sulfur oxide removal	546	2,100	3.85
Special:			
Asphalt fillers or extenders	(5/)	(5/)	10.22
Whiting or whiting substitute	(5/)	(5/)	10.99
Other fillers or extenders	479	11,300	23.61
Unspecified: 6/			
Actual	1,450	6,210	4.29
Estimated	12,200	43,400	3.57
Total	86,500	341,000	3.94

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Includes calcareous marl, dolomite, granite, limestone, marble, miscellaneous stone, sandstone, traprock, and volcanic cinder and scoria.
2/ Data are rounded to three significant digits, except unit values; may not add to totals shown.
3/ Includes macadam.
4/ Includes waste material.
5/ Withheld to avoid disclosing company proprietary data; included in "Total."
6/ Includes production reported without a breakdown by end use and with estimates fornonrespondents.

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TABLE 4
TEXAS: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 4		District 5	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	(4/)	3	6	49	517	2,910
Coarse aggregate, graded 5/	W	W	W	W	10,100	51,700
Fine aggregate (-3/8 inch) 6/	W	W	W	W	3,490	15,700
Coarse and fine aggregate 7/	235	992	1,930	9,320	7,440	32,700
Agricultural 8/	--	--	--	--	(9/)	(9/)
Chemical and metallurgical 10/	--	--	(9/)	(9/)	(9/)	(9/)
Special 11/	--	--	--	--	(9/)	(9/)
Unspecified: 12/						
Actual	--	--	(9/)	(9/)	137	538
Estimated	1,090	2,950	(9/)	(9/)	5,820	22,800
Total	1,330	3,950	7,360	28,500	31,400	144,000

	District 7		District 9		District/unspecified	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	671	3,540	--	--	--	--
Coarse aggregate, graded 5/	13,500	59,900	--	--	--	--
Fine aggregate (-3/8 inch) 6/	3,700	15,000	--	--	--	--
Coarse and fine aggregate 7/	15,800	41,500	2,550	6,900	--	--
Agricultural 8/	(9/)	(9/)	--	--	--	--
Chemical and metallurgical 10/	7,240	19,000	--	--	--	--
Special 11/	(9/)	(9/)	--	--	--	--
Unspecified: 12/						
Actual	687	2,010	(9/)	(9/)	--	--
Estimated	1,450	4,790	(9/)	(9/)	212	661
Total	43,600	157,000	2,600	7,080	212	661

W Withheld to avoid disclosing company proprietary data; included with "Coarse and fine aggregate."
1/ Production reported in District 2 and 3 was included with "District 4"; District 6 was included with "District 5"; District 8 was included with "District 7"; to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Less than 1/2 unit.
5/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
6/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
7/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill), other coarse and fine aggregates, other construction materials, and waste material.
8/ Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.
9/ Withheld to avoid disclosing company proprietary data; included in "Total."
10/ Includes cement manufacture, chemical stone for alkali works, lime manufacture, and sulfur oxide removal.
11/ Includes asphalt fillers or extenders, other fillers or extenders and whiting or whiting substitute.
12/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 5
TEXAS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	23,200	$115,000	$4.96
Plaster and gunite sands	259	1,590	6.13
Concrete products (blocks, bricks, pipe, decorative, etc.)	325	817	2.51
Asphaltic concrete aggregates and other bituminous mixtures	1,330	7,910	5.94
Road base and coverings 2/	2,460	7,970	3.24
Fill	4,350	9,230	2.12
Other miscellaneous uses 3/	964	3,840	3.98
Unspecified: 4/			
Actual	6,460	31,000	4.80
Estimated	22,000	100,000	4.57
Total or average	61,300	278,000	4.53

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes filtration, railroad ballast, and roofing granules.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 6
TEXAS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	568	3,830	(4/)	(4/)	527	5,150
Asphaltic concrete aggregates and road base materials 5/	767	4,900	(4/)	(4/)	64	268
Other miscellaneous uses 6/	1	9	--	--	10	89
Unspecified: 7/						
Actual	53	250	182	741	2	19
Estimated	1,670	7,830	1,410	6,700	1,580	8,740
Total	3,060	16,800	2,840	14,800	2,180	14,300

Use	District 5		District 6		District 7	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	8,010	40,600	(4/)	(4/)	2,460	11,300
Asphaltic concrete aggregates and road base materials 5/	818	2,470	(4/)	(4/)	1,270	2,810
Other miscellaneous uses 6/	88	145	--	--	3	7
Unspecified: 7/						
Actual	3,500	17,100	--	--	1,750	9,270
Estimated	5,150	20,300	668	3,460	1,630	5,480
Total	17,600	80,600	1,020	5,100	7,110	28,900

Use	District 8		District 9	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	8,510	34,900	(4/)	(4/)
Asphaltic concrete aggregates and road base materials 5/	4,600	11,300	(4/)	(4/)
Other miscellaneous uses 6/	862	3,590	--	--
Unspecified: 7/				
Actual	978	3,660	--	--
Estimated	6,200	26,700	3,660 8/	21,100 8/
Total	21,100	80,200	6,410 8/	37,100 8/

1/ Production reported in District 2 was included with "District 3" to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Withheld to avoid disclosing company proprietary data; included in "Total."
5/ Includes fill and road and other stabilization (cement and lime).
6/ Includes filtration, railroad ballast, and roofing granules.
7/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.
8/ Includes production within the state with no district reported.

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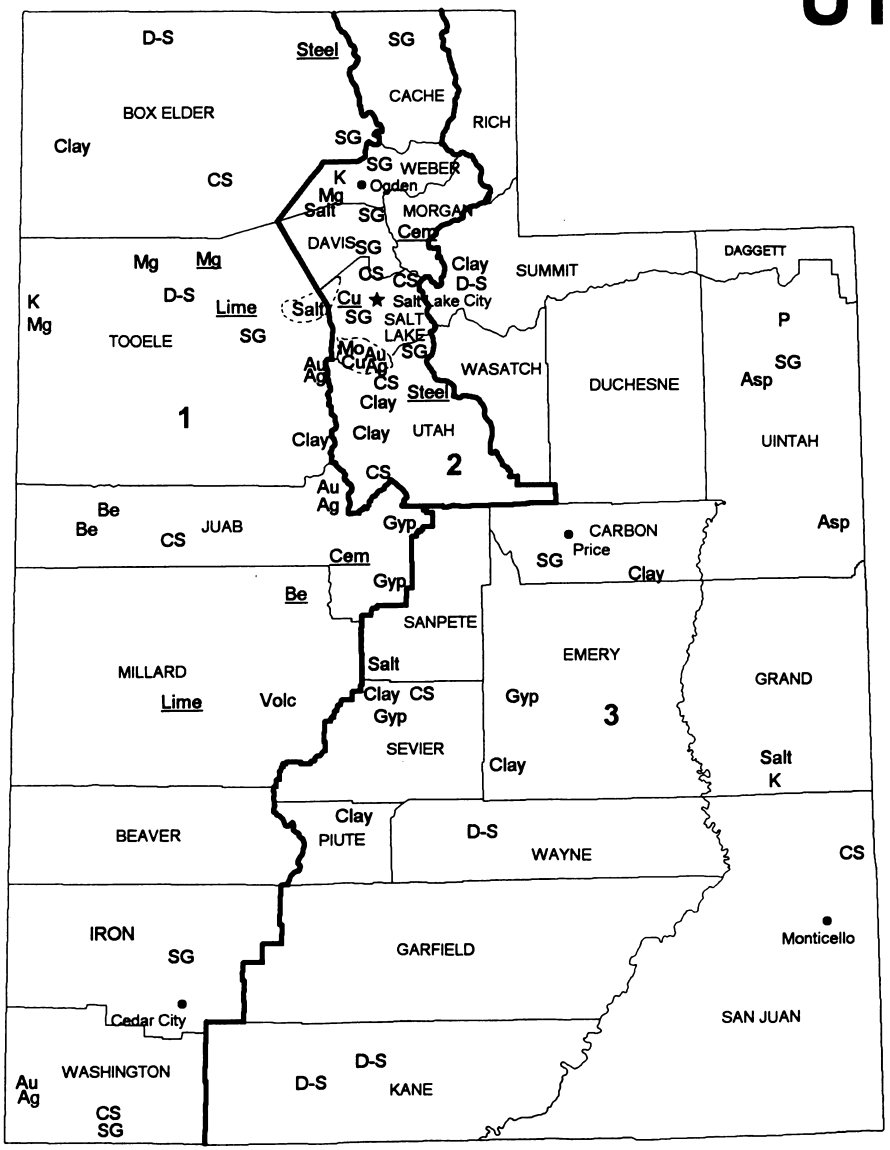

LEGEND

- State boundary
- County boundary
- ★ Capital
- ● City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Ag	Silver
Asp	Asphaltite
Au	Gold
Be	Beryllium
Be	Beryllium plant
Cem	Cement plant
Clay	Clay
CS	Crushed stone
Cu	Copper
Cu	Copper plant
D-S	Dimension sandstone
Gyp	Gypsum
K	Potash
Lime	Lime plant
Mg	Magnesium
Mg	Magnesium metal plant
Mo	Molybdenum
P	Phosphate rock
Salt	Salt
SG	Sand and gravel
Steel	Iron and steel plant
Volc	Volcanic cinders
⬭	Concentration of mineral operations

0 — 100 Kilometers

Source: Utah Geological Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF UTAH

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Utah Geological Survey for collecting information on all nonfuel minerals.

In 1997, Utah climbed in rank to fifth from sixth nationally in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $1.76 billion, a less than 2% increase of from that of 1996. This followed a 6.5% decrease from 1995 to 1996 (based on final 1996 data). The State accounted for about 4.5% of the U.S. total nonfuel mineral production value.

Metals accounted for nearly three-quarters of Utah's nonfuel mineral production value, copper being the majority of the State's entire metal value. In 1997, increases in construction sand and gravel (*table 1*), phosphate rock, and copper (unit price and production) values together with smaller increases in crushed stone (*table 1*), potash, portland cement, and molybdenum accounted for most of the increases in nonfuel mineral value. (All listings are in descending order of relative change.) The largest decreases occurred in magnesium metal, down 14%, and gold, down 9%. Silver, salt, and gemstones also showed small decreases. In 1996, a decrease in the value of copper accounted for most of the State's decrease in nonfuel mineral value. Nearly all other mineral commodities showed an increase, especially molybdenum, salt (*table 1*), gold, magnesium metal, and potash. A small drop occurred in phosphate rock; other decreases were marginal.

Based on USGS estimates of the quantities produced in the United States during 1997, Utah remained the only State to produce beryllium concentrates; second in copper and second of 3 magnesium metal- and 4 potash-producing States; third in molybdenum and third of 3 States that produce mercury; fourth in phosphate rock and grade-A helium; fifth in silver; and sixth in salt and bentonite. Utah rose to 2d from 3d in gold, and to 10th from 13th in construction sand and gravel and dropped from 3d to 4th in magnesium compounds. Additionally, the State was a significant producer of lime.

The following narrative information was provided by the Utah Geological Survey[2] (UGS). According to the UGS, the total value of metallic minerals and industrial rocks and minerals produced in Utah for 1997, estimated at about $ 1.76 billion, can be divided into categories as follows: base metals—about $938 million; industrial rocks and minerals, gemstones, and fossils—$533 million; and precious metals—$289 million. (All nonfuel mineral values and quantities of minerals produced cited in the remainder of this narrative are from UGS company surveys and UGS estimates.) Base and precious metal production was relatively high, but prices were lower for most metals. Industrial mineral production reached new highs for several commodities; prices increased modestly for most commodities but were lower for several others. Excluding sand and gravel operations, 51 large mines (greater than two hectares surface disturbance) were active in 1997. These included three base metal operations, two precious metal mines, and 46 industrial mineral operations. Ninety-six small mines (fewer than two hectares surface disturbance) reported production in 1996 (latest data available). The number of small mines were grouped by production as follows: industrial rocks and minerals—66, gemstones—13, precious metals—11, fossils—3, and other—3.

Base metal production was the largest contributor to the value of minerals produced in Utah. In descending order of value the main commodities were: copper, magnesium metal, molybdenum, and beryllium. Copper production in 1997 was estimated by the UGS to be slightly higher than the 1996 production of about 300,000 metric tons of metal. Molybdenum production was estimated at about 17,250 tons of molybdenum concentrate (MoS_2), slightly less than in 1996. The copper and molybdenum production was from Kennecott Utah Copper Corp.'s Bingham Canyon Mine. Other contributions to Utah's base metal production include beryllium oxide produced by Brush Wellman Inc. from bertrandite ores mined at Topaz Mountain and magnesium metal produced from Great Salt Lake brines by Magnesium Corp. of America. Beryllium and magnesium metal production in 1997 was estimated to be about the same level as in 1996. No iron, lead, or zinc production was reported in Utah for 1997.

Industrial minerals were the second-largest contributor to the value of minerals produced in 1997. Major commodities produced by group or individual commodity in descending order of value include: (1) salines, including sulfate of potash, salt, potash, and magnesium chloride, (2) sand and gravel, and crushed stone, (3) portland cement, (4) phosphate, (5) lime, limestone, and dolomite, (6) gilsonite, (7) common clay and bentonite, and (8) gypsum.

Salines were produced by six companies in Utah; 1997

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Robert Gloyn, a Senior Geologist with the Utah Geological Survey authored the text of mineral industry information provided by the Utah Geological Survey.

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production is estimated at 2.5 million tons, substantially less than in 1996. Portland cement was produced by two companies in Utah; both are operating near their combined annual capacity of 900,000 tons of cement and have plans to expand. Phosphate was produced by SF Phosphates Ltd. in Uintah County; 1997 production is estimated at 2.25 tons of ore. Two companies produced quick or hydrated lime in Utah with a combined capacity of nearly 500,000 tons per year. Several other companies mined limestone for direct use in electric power plants, in steel mills, and for use as aggregate in construction. Three companies produced gilsonite from veins in eastern Utah; 1997 production is estimated at more than 55,000 tons, similar to 1996 production. Nearly 160,000 tons of common clay and over 40,000 tons of bentonite were produced by four companies in 1997. Common clay production was slightly lower than in 1996, but 1997 bentonite production was about the same as 1996 production. Six companies produced gypsum in Utah for 1997; production was more than 330,000 tons, slightly higher than in 1996. Most gypsum was used for making wall board, but some was used in cement plants and for agricultural purposes. Commodities produced in lesser amounts include: fuller's earth, building stone, decorative stone, lightweight aggregate, masonry cement, and gemstones.

Precious metal production in 1997 is estimated at nearly 25 tons of gold and 149 tons of silver. Gold was produced from three surface mines, two primary producers (Barrick Gold Corp.'s Barrick Mercur Mine and Kennecott Minerals Co.'s Barneys Canyon Mine) and one by-product producer (Kennecott's Bingham Canyon Mine). Silver was produced as a secondary metal at the Mercur mine and as a by-product metal at the Bingham Canyon Mine. About 75% of the gold and over 90% of the silver produced were from the Bingham Canyon Mine.

Operator surveys indicate that most base metal production will remain relatively steady in 1998 but with some decrease in molybdenum production due to lower grade ore. Precious metal production, particularly gold, will show a sharp decline in 1998 due to final mill shutdown at the Mercur Mine, phasing out of production at the Barneys Canyon Mine, and scheduled mining of a lower gold grade portion of copper deposit at the Bingham Canyon Mine. However, industrial mineral production should remain at current high levels and should even increase with new mine development and expansion of existing facilities.

Several new industrial mineral mines or quarries began production in 1997; mining was completed at one precious metal operation, and the anticipated opening of three base metal mines was postponed.

New operations in Utah for 1997 include at least two aggregate quarries, one railroad ballast quarry, one dimension stone quarry, three clay pits, two gypsum mines, one gilsonite mine, one perlite mine, and one beryllium open-pit adjacent to an existing operation. In addition, permits have been granted from two new saline operations which should be producing within several years.

Mining ceased at the Barrick Mercur Mine in March 1997 after 15 years of mining. The mill will continue to operate until late 1998, and mine closure reclamation will continue through 2010.

Construction and mining at Summo Minerals Corp.'s Lisbon Valley copper mine in southeastern Utah has been delayed at least 12 to 15 months because the U.S. Interior Board of Land Appeals issued a Partial Stay preventing Summo from mining. The stay was issued after the Final Environmental Impact Statement and Record of Decision to permit mining was appealed by a Moab, Utah-based environmental group. Summo is hopeful that the stay will be lifted by April or May 1998, so construction can proceed. Start-up at the Nevada Star Resource Corp.'s O. K. copper mine in Beaver County has also been delayed due to a change in ownership and acquisition/evaluation of adjacent copper properties. A feasibility study for the combined properties is being prepared, and arrangements are being made to obtain project financing. Nevada Star Resource Corp. expects project financing to be in place by mid-1998 with construction and mine development to start immediately after. Mining will not begin as quickly as originally anticipated at Tintic Metals L.L.C.'s Burgin lead-zinc-silver mine in the East Tintic district. Additional work is concentrating on improving milling and recovery techniques and on mine planning and water disposal. The Burgin Mine start up could be postponed as much as several years while the joint-venture develops more easily mined ore in adjacent properties.

Mineral exploration statewide remains at a relatively low level. Thirty-four Notices of Intent (NOI) to explore were filed with the Utah Division of Oil, Gas and Mining in 1997 compared to 32 in 1996 and 22 in 1995. Over 60% of the NOIs were for precious metals with or without associated base metals. Nearly all of the precious metal NOIs were from individuals or from small to medium sized companies. Very few NOIs were from major or multi-national companies. The other NOIs were mostly for industrial minerals including limestone, phosphate, black sands, clay, cinders, and hydrocarbons.

Kennecott released information on its new magnetite-copper skarn discovery at Bingham Canyon. The discovery, named the Fortuna skarn, occurs east of the North Ore Shoot deposit and is in skarns developed from the Jordan Limestone along the Copperton anticline. No reserves have been announced, but reported intercepts include 20 meters of 4.4 % copper and 3.3 grams per metric ton gold and 60 meters of 4.0 % copper and 1.8 grams per metric ton gold.

No other major discoveries have been announced.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN UTAH 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Beryllium concentrates	metric tons	5,040	6	5,260	6	5,300	6
Clays:							
Bentonite		38	W	W	1,400	45	1,080
Common		386	4,280	298	4,510	401	4,220
Fuller's earth		--	--	W	32	--	--
Gemstones		NA	939	NA	1,150	NA	221
Iron ore, usable		144	1,700	--	--	--	--
Salt		2,160	54,800	1,720	70,400	1,800	67,100
Sand and gravel, construction		23,800	80,200	24,700	80,500	33,000	110,000
Stone, crushed		4,140	14,800	4,380	19,100	6,000	27,000
Combined value of cement, copper, gold, gypsum (crude), helium (Grade-A), lime, magnesium compounds, magnesium metal, mercury, molybdenum, phosphate rock, potash, silver, stone (dimension quartzite and sandstone), and value indicated by symbol W		XX	1,700,000	XX	1,560,000	XX	1,550,000
Total		XX	1,850,000	XX	1,730,000	XX	1,760,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data.
XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
UTAH: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone 2/	16	2,080	$8,860	$4.25	10	1,480	$8,500	$5.76
Dolomite	2	W	W	2.65	4	W	W	3.42
Sandstone	3	W	W	5.46	3	W	W	5.78
Granite	--	--	--	--	1	W	W	3.33
Quartzite	--	--	--	--	1	W	W	9.00
Volcanic cinder and scoria	--	--	--	--	1	W	W	10.83
Total	XX	4,140	14,800	3.58	XX	4,380	19,100	4.35

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits except unit value; may not add to totals shown.
2/ Includes "limestone-dolomite," reported with no distinction between the two.

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TABLE 3
UTAH: CRUSHED STONE SOLD OR USED
BY PRODUCERS IN 1996, BY USE 1/ 2/ 3/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Fine aggregate (-3/8 inch), screening, undesignated	10	$40	$4.00
Coarse and fine aggregates:			
Graded road base or subbase	690	2,080	3.02
Unpaved road surfacing	90	262	2.91
Other construction materials 4/	1,500	4,480	2.98
Agricultural, poultry grit and mineral food	W	W	21.60
Chemical and metallurgical:			
Cement manufacture	W	W	5.15
Lime manufacture	W	W	6.18
Flux stone	W	W	10.15
Sulfur oxide removal	W	W	6.94
Special:			
Mine dusting or acid water treatment	W	W	22.84
Other specified uses not listed	W	W	8.73
Unspecified: 5/			
Actual	240	890	3.71
Estimated	32	71	2.22
Total	4,380	19,100	4.35

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ To avoid disclosing company proprietary data; "District tables were not produced in 1996."
2/ Includes dolomite, granite, limestone, limestone-dolomite, quartzite, sandstone, and volcanic cinder and scoria.
3/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
4/ Includes bituminous aggregate (coarse), crusher run (select material or fill), other coarse aggregate, riprap and jetty stone, stone sand (bituminous mix or seal), and terrazzo and exposed aggregate.
5/ Includes production reported without a breakdown by use and with estimates for nonrespondents.

TABLE 4
UTAH: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	4,760	$15,400	$3.23
Plaster and gunite sands	475	1,460	3.08
Concrete products (blocks, bricks, pipe, decorative, etc.)	164	581	3.54
Asphaltic concrete aggregates and other bituminous mixtures	1,550	6,790	4.37
Road base and coverings	4,770	15,100	3.17
Fill	3,470	6,760	1.95
Snow and ice control	29	73	2.52
Other miscellaneous uses 2/	252	917	3.64
Unspecified: 3/			
Actual	2,890	10,300	3.56
Estimated	6,310	23,200	3.68
Total or average	24,700	80,500	3.26

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filtration and roofing granules.
3/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 5
UTAH: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	1,570	5,550	3,700	11,100
Asphaltic/bituminous mixtures	679	2,370	W	W
Road base and coverings	1,230	3,890	2,300	6,480
Fill	949	2,120	2,370	4,390
Snow and ice control	14	35	W	W
Other miscellaneous uses 3/	60	352	403	1,420
Unspecified: 4/				
Actual	4	15	2,860	10,200
Estimated	501	1,500	4,460	13,500
Total	5,000	15,800	16,100	47,100
	District 3		District unspecified	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	127	806	--	--
Asphaltic/bituminous mixtures	W	W	225	908
Road base and coverings	1,020	3,850	222	895
Fill	153	257	--	--
Snow and ice control	W	W	--	--
Other miscellaneous uses 3/	453	2,710	--	--
Unspecified: 4/				
Actual	22	57	--	--
Estimated	1,340	8,150	--	--
Total	3,120	15,800	447	1,800

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes filtration and roofing granules.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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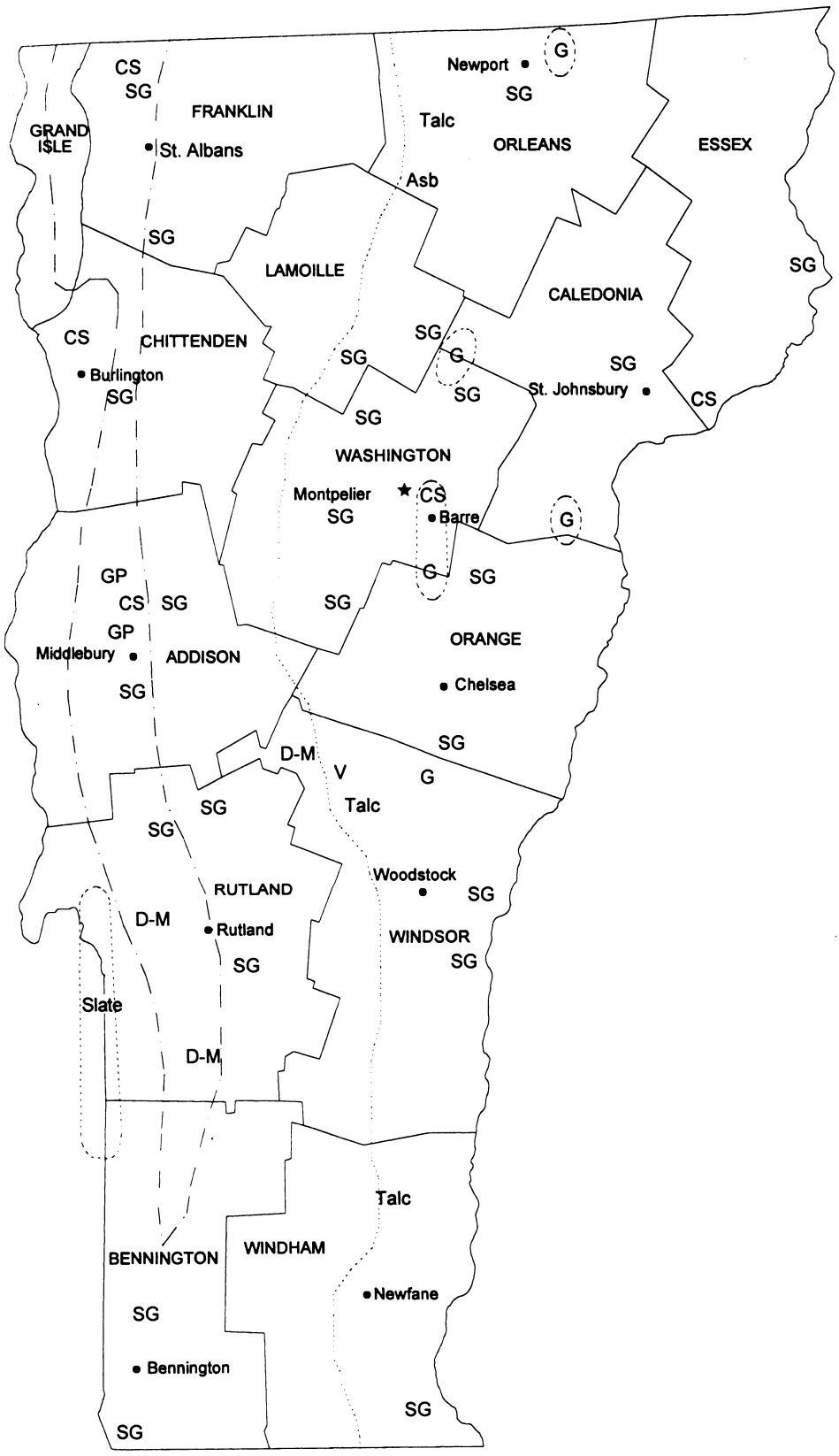
VERMONT



LEGEND

- State boundary
- County boundary
- ★ Capital
- • City

MINERAL SYMBOLS

Asb	Asbestos
CS	Crushed stone
D-M	Dimension marble
D-G	Dimension granite
GP	Finely ground products
SG	Sand and gravel
Slate	VT/NY slate district
Talc	Talc minerals
V	Verde antique

Concentration of mineral operations

VT limestone-marble belt

Ultramafic trend -includes asbestos, talc and verde antique operations

0 50 Kilometers

Source: Vermont Geological Survey, Office of the State Geologist/U.S. Geological Survey

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THE MINERAL INDUSTRY OF VERMONT

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Vermont Geological Survey, Office of the State Geologist, for collecting information on all nonfuel minerals.

In 1997, Vermont ranked 45th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The State was 46th in 1996. The estimated value for 1997 was $68 million, a more than 3% increase from that of 1996. This followed a 9.3% increase from 1995 to 1996 (based on final 1996 data). The State accounted for somewhat less than 0.5% of the U.S. total nonfuel mineral production value.

The increased value of crushed stone provided nearly all of Vermont's increase in value in 1997. Dimension stone had a marginal increase, construction sand and gravel dropped by $1 million, and gemstones remained unchanged (*table 1*). In 1996, increases in the values of construction sand and gravel and crushed stone accounted for the State's significant increase in value. Dimension stone showed a small drop and gemstones remained unchanged. Although data regarding talc production must be concealed to protect company data, that mineral commodity's value increased in 1997, following a smaller decrease in 1996. Compared with USGS estimates of the quantities produced in the 50 States during 1997, Vermont remained third in rank in the production of both dimension stone and talc.

The following narrative information was provided by the Vermont Geological Survey[2] (VGS). Rock of Ages Corp., a manufacturer and retailer of dimension granite and granite memorials based in Graniteville, Washington County, completed its initial public offering of Class A Common Stock on October 24, 1997. The company acquired Childs & Childs Granite Co. of Elberton, GA, and the Keith Monument Co. of Elizabethtown, KY. Rock of Ages owns and operates four quarries in the towns of Barre (two), Bethel, and Woodbury in addition to nine other granite quarries in North America.

The owner of Gawet Marble in Windham, Windham County, received an Act 250 (Vermont's Land Use and Development Law) permit in 1996 and began removal of existing blocks of verde antique marble in 1997. Verde antique marble is a mixture of massive serpentine, a translucent light-to-dark-green-colored rock, and white marble, which together show beautiful variegated coloring. It is often used as an ornamental stone and may be valuable as building material. Quarry operations are scheduled to begin in the spring of 1998.

In 1995, the Vermont Legislature enacted Act 30, adding subsections (j) through (l) to Title 10 of the Vermont Statutes Annotation Section 6081 of the Act 250 statute. Act 30 established a slate quarry registration program whereby quarries which are properly registered are deemed to be active (not abandoned) and exempt from Act 250 for enumerated "ancillary activities" (i.e., "Drilling, crushing, grinding, sizing, washing, drying, sawing and cutting stone, blasting, trimming, punching, splitting and gauging, and use of buildings and the use and construction of equipment exclusively to carry out the above activities"). During 1997, 125 Act 250 Jurisdictional Opinions were issued, thereby accepting the 1996 registration applications for more than 200 slate quarry holes in Vermont.

During the summer of 1997 the VGS in cooperation with the USGS Eastern Mineral Resources Team (EMRT) began the process of updating the mineral resource data of the State. The 2 agencies contracted with F.M. Beck Co. of Maine to review the 700 Vermont listings in the USGS Mineral Resources Data System (MRDS) for accuracy and to make corrections and/or additions where necessary. In addition, a select subset of about 200 MRDS records will be assigned mineral deposit type. The updated assessment will be used in a planning process that focuses on how the VGS can best serve the citizens of the State in regards to mineral-resource issues.

The VGS, also known as the Division of Geology and Mineral Resources in Vermont's Department of Environmental Conservation, conducts surveys and research of the geology, mineral resources, and topography of the State. Of late, emphasis has been on preparation of a bedrock map of Vermont and interim digital map products. A surficial mapping program began in 1996. The State Geologist manages interdisciplinary studies with strong geologic components, especially those focused on surface waters and groundwater resources. Review of projects as they relate to Criteria 9D and 9E of the aforementioned Act 250 is a VGS activity that recognizes the importance of lands with high potential for extraction of mineral and earth resources. The VGS also reviews and makes recommendations regarding mine and quarry reclamation plans in response to current environmental concerns. Published reports are prepared and made available to the public, consultants, industry, and government. The VGS collates and disseminates this practical knowledge in packages ready for the consumer, providing geologic aid and advice to the public as required by State statute.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. Construction sand and gravel and crushed stone estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Marjorie Gale, Geologist/Information and Education Officer at the Vermont Geological Survey, submitted the information provided by that agency.

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The VGS also provides advice concerning the development and working of rock and mineral deposits suitable for building, road making, and economic purposes. The VGS maintains an archive of old and new information as per State statute. In the event of any significant discovery of hydrocarbons in the State, the Survey provides geologic services for Vermont's Natural Gas and Oil Resources Board.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN VERMONT 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified

Mineral		1995 Quantity	1995 Value	1996 Quantity	1996 Value	1997 p/ Quantity	1997 p/ Value
Gemstones		NA	1	NA	1	NA	1
Sand and gravel, construction		3,220	11,000	3,870	15,200	3,510	14,100
Stone:							
Crushed		4,420	20,700	4,560	22,800	5,100	26,000
Dimension	metric tons	100,000	28,700	99,600	27,900	100,000	28,100
Total 3/		XX	60,400	XX	66,000	XX	68,200

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Partial total, excludes values that must be concealed to avoid disclosing company proprietary data.

TABLE 2
VERMONT: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone	6 r/	2,080 r/	$7,610 r/	$3.65 r/	6	2,260	$8,440	$3.74
Dolomite	6	W	W	5.38	2	W	W	9.06
Marble	2	W	W	3.90	3	1,030	4,610	4.46
Granite	2	48	W	W	2	W	W	5.84
Quartzite	3 r/	W	W	W	3	1,120	8,600	7.71
Slate	1	W	W	9.61	1	W	W	9.92
Total	XX	4,420	20,700	4.68	XX	4,560	22,800	5.01

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 3
VERMONT: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	13	$104	$8.00
Filter stone	12	93	7.75
Coarse aggregate, graded:			
Concrete aggregate, coarse	129	1,060	8.19
Bituminous aggregate, coarse	263	2,240	8.50
Bituminous surface-treatment aggregate	166	1,350	8.11
Railroad ballast	12	94	7.83
Fine aggregate (-3/8 inch):			
Stone sand, concrete	122	965	7.91
Stone sand, bituminous mix or seal	172	1,250	7.27
Other fine aggregate 3/	9	78	8.67
Coarse and fine aggregates:			
Graded road base or subbase	143	1,150	8.06
Unpaved road surfacing	113	887	7.85
Other construction materials 4/	99	751	7.59
Agricultural, other agricultural uses	W	W	4.38
Unspecified: 5/			
Actual	1,110	4,090	3.69
Estimated	W	W	3.95
Total	4,560	22,800	5.01

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, granite, limestone, marble, quartzite, and slate.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes screening (undesignated).
4/ Includes crusher run (select material or fill).
5/ Includes production reported without a breakdown by use and with estimates for nonrespondents.

TABLE 4
VERMONT: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	548	$3,320	$6.05
Plaster and gunite sands	7	78	11.14
Asphaltic concrete aggregates and other bituminous mixtures	131	788	6.02
Road base and coverings	1,290	4,880	3.80
Fill	207	444	2.14
Snow and ice control	438	1,350	3.09
Other miscellaneous uses 2/	241	1,410	5.84
Unspecified: 3/			
Actual	97	457	4.71
Estimated	921	2,500	2.72
Total or average	3,870	15,200	3.93

1/ Data are rounded to three significant digits except value per ton; may not add to totals shown.
2/ Includes filtration.
3/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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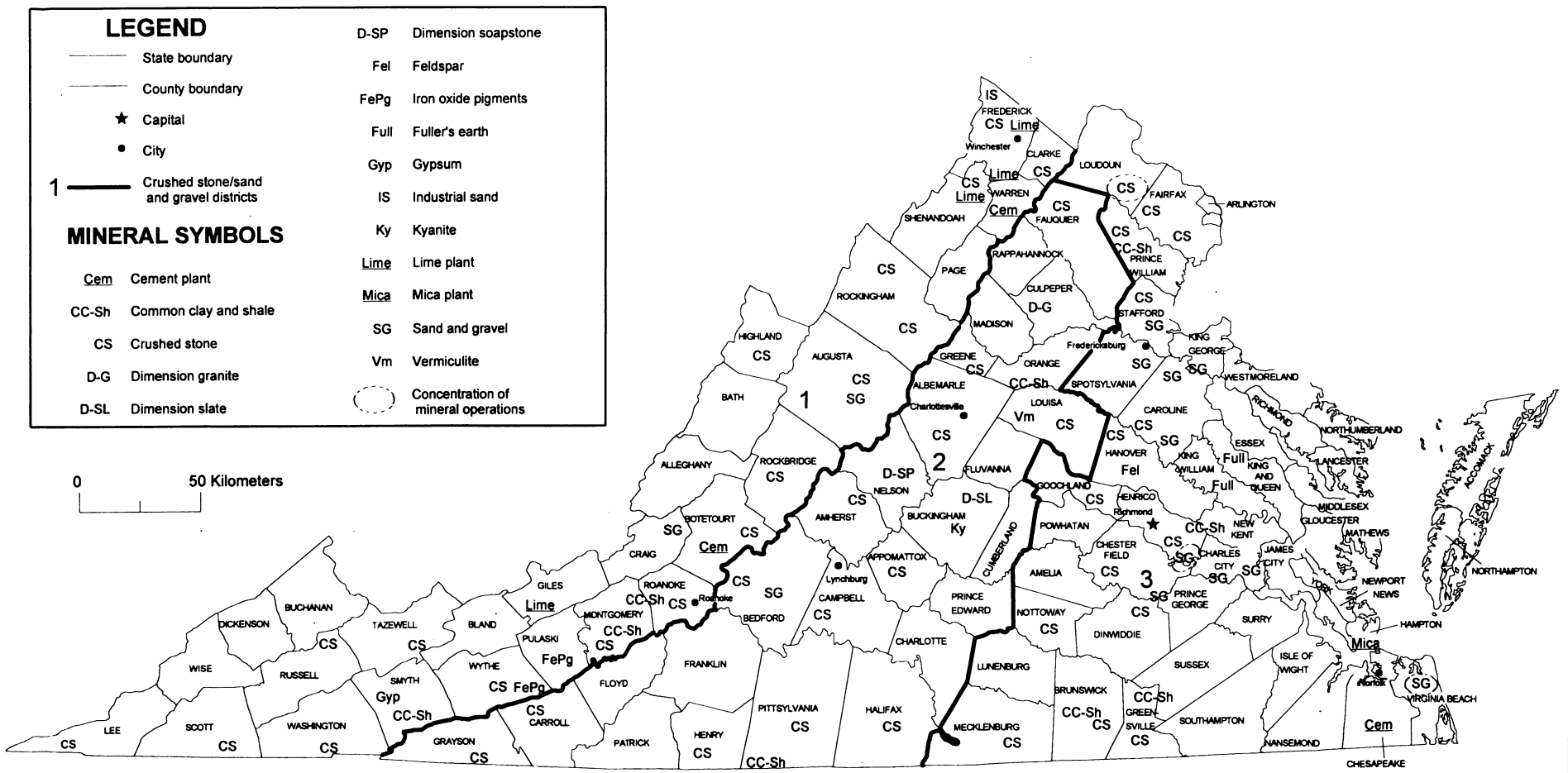
VIRGINIA



Source: Virginia Division of Mineral Resources/U.S. Geological Survey

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THE MINERAL INDUSTRY OF VIRGINIA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and theVirginia Department of Mines, Minerals and Energy for collecting information on all nonfuel minerals.

In 1997, Virginia remained 22d in rank among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $600 million, about a 9% increase from that of 1996. This followed a 6.6% increase from 1995 to 1996 (based on final 1996 data). The State accounted for 1.5% of the U.S. total nonfuel mineral production value.

Virginia mines produce industrial minerals and coal. The last significant metal production took place in 1981 when the State's only consistently active metal mine, an underground zinc operation, closed down because of the recession and a depressed metal market. While a diverse variety of minerals was produced in Virginia in 1997, crushed stone accounted for 65% of the State's nonfuel mineral value. From 1990 through 1997, Virginia produced more than 430 million metric tons of crushed stone, or an average of almost 54 million metric tons per year. In 1997, the value of crushed stone increased by about $41 million, the most of any nonfuel mineral in the State; construction sand and gravel also had a significant increase (*table 1*). Crude gypsum and talc showed small decreases; gemstones, crude iron oxide pigments, and industrial sand and gravel remained unchanged. In 1996, crushed stone accounted for the largest portion of the State's increase in mineral value; lime, construction sand and gravel, masonry cement, and kyanite also contributed to the rise in value. Portland cement production and value dropped by about 11%.

Based on USGS estimates of quantities produced in the 50 States during 1997, Virginia remained the only State to mine kyanite; second of 2 States that produce vermiculite; third in feldspar; fourth in crude iron oxide pigments; and ninth in lime. The State climbed in rank to seventh from eighth in the production of crushed stone. Additionally, significant quantities of masonry cement and common clays were produced in the State. While the only producing kyanite mine in the United States was in Virginia, mullite, a calcined kyanite, was synthetically produced in one other State. About 90% of U.S. kyanite and mullite output is used in refractories for the smelting and processing of a variety of metals and in glass and high-temperature ceramics manufacturing.

The following narrative information was provided by the Virginia Division of Mineral Resources (VDMR).[2] A division of Ralston Purina Co., Golden Cat, began producing cat box filler, during the summer, at its new manufacturing plant, located about 25 miles northeast of Richmond. The plant uses fuller's earth from King and Queen County.

In mid-October, RGC (USA) Mineral Sands, Inc. officially opened its titanium mining and processing operations in the town of Stony Creek, Dinwiddie County, south of Richmond. The company has invested almost $50 million in the operation; the processing and mining operations have created 70 jobs, and hauling and supply services and contract mining operations have created an additional 25 jobs.

Vulcan Materials Co., Winston Salem, NC, announced in the fall the reopening of its Low Moor Quarry in Alleghany County. This quarry, located in Middle Ordovician limestones in the western part of the State, in the past produced roadstone, asphalt stone, and riprap.

The VDMR continued geologic mapping in several counties at a detailed (1:24,000) scale and continued to map, compile, and digitize 1:100,000-scale maps. The agency also continued field studies and compilation of mineral resources on 1:24,000 scale maps; a coalbed methane resources study; oil and gas studies of Dickenson and Russell Counties; a paper updating byproduct resources in the State; articles on clay deposits in Augusta and Rockbridge Counties; and a history of brick production in the Albemarle County and City of Charlottesville area. Published during the year were two statistics reports on coal, oil and gas, and industrial and metallic mineral resources produced in the State for 1995-96. Additional work included a study on ancient warm springs deposits in Bath and Rockingham Counties; a report on the metallic mines, prospects, and occurrences in the gold-pyrite belt of Virginia; a geologic map of the Roanoke 30 x 60-minute quadrangle; a report on Virginia's coal ages; and a brochure on the "Geology of Virginia." During the year, two brochures, "Virginia Diamonds" and "Gold in Virginia," were revised.

The Division continued to move forward with implementation of digital mapping technology, with the intent being to make data available to customers in computer-ready formats and to reduce map printing and storage costs by printing maps "on-demand." Many topographic maps and several geologic maps are already available in digital form, and many other products were being prepared.

Complete State topographic coverage is available as Digital Raster Graphics, referred to as DRG's. These color-compressed,

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Palmer Sweet, Head Geologist with the VDMR, authored the text of mineral industry information submitted by that agency.

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georeferenced raster images of USGS topographic maps are at 1:24,000, 1:100,000, and 1:250,000 scales. For the coal-bearing portion of Virginia, all 1:24,000-scale topographic maps have been vectorized and are available on CD-ROM. A program to vectorize topographic contours for the remaining quadrangles in the Commonwealth is in the planning stage.

Many published geologic maps are undergoing digitization, and some newer maps are being produced by digital processes, completely bypassing conventional printing. For example, a new geologic overview map of the Southwest Virginia Coalfields will be available as a digital dataset or as a "map-on-demand." The Division has worked closely with suppliers of plotter media to develop and test papers and inks that will stand up to the rigors of field use.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN VIRGINIA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Common	844	3,200	883	3,220	862	3,340
Fuller's earth	46	W	46	W	48	W
Gemstones	NA	W	NA	11	NA	11
Lime	731	41,900	766	45,700	774	46,200
Sand and gravel, construction	9,710	42,300	9,780	45,800	11,300	54,200
Stone, crushed	55,400	326,000	59,700	351,000	66,000	392,000
Combined value of cement, feldspar, gypsum (crude), iron oxide pigments (crude), kyanite, sand and gravel (industrial), stone [dimension dolomite, slate, and traprock (1995), dimension dolomite, granite, slate, and traprock (1996-97)], talc and pyrophyllite (1996-97), vermiculite, and values indicated by symbol W	XX	101,000	XX	103,000	XX	104,000
Total	XX	515,000	XX	549,000	XX	600,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
CRUSHED STONE SOLD OR USED BY PRODUCERS IN VIRGINIA, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone 2/	42	15,800	$89,600	$5.69	43	16,500	$94,600	$5.73
Dolomite	10	3,650	28,100	7.71	12	4,480	30,900	6.91
Granite	32	21,100	119,000	5.64	30	24,000	138,000	5.74
Traprock	10	12,600	73,200	5.84	11	12,500	71,900	5.74
Sandstone and quartzite	7	1,390	7,310	5.27	7	1,190	6,810	5.71
Slate	2	W	W	W	2	W	W	W
Other miscellaneous stone	2	W	W	W	2	W	W	W
Total	XX	55,400	326,000	5.89	XX	59,700	351,000	5.87

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes "limestone-dolomite," reported with no distinction between the two.

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TABLE 3
VIRGINIA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	318	$1,230	$3.87
Riprap and jetty stone	1,320	10,500	7.91
Filter stone	982	5,780	5.88
Other coarse aggregate	267	2,040	7.65
Coarse aggregate, graded:			
Concrete aggregate, coarse	6,610	41,800	6.32
Bituminous aggregate, coarse	3,770	23,700	6.29
Bituminous surface-treatment aggregate	2,750	18,900	6.88
Railroad ballast	519	2,850	5.50
Other graded coarse aggregate	1,170	7,070	6.02
Fine aggregate (-3/8 inch):			
Stone sand, concrete	744	5,240	7.04
Stone sand, bituminous mix or seal	837	5,240	6.26
Screening, undesignated	1,790	9,990	5.59
Coarse and fine aggregates:			
Graded road base or subbase	10,300	53,300	5.18
Unpaved road surfacing	663	3,750	5.66
Crusher run or fill or waste	3,370	15,700	4.67
Other coarse and fine aggregates	327	1,540	4.70
Other construction materials 3/	798	6,760	8.47
Agricultural:			
Agricultural limestone	570	5,880	10.32
Poultry grit and mineral food	108	1,240	11.51
Other agricultural uses	96	1,060	10.99
Chemical and metallurgical:			
Cement manufacture	W	W	3.71
Lime manufacture	796	4,280	5.38
Flux stone	W	W	10.17
Chemical stone	W	W	10.97
Glass manufacture	W	W	12.39
Sulfur oxide removal	W	W	7.89
Special:			
Mine dusting or acid water treatment	192	3,320	17.29
Asphalt fillers or extenders	136	1,160	8.54
Whiting or whiting substitute	W	W	31.00
Other fillers or extenders	W	W	11.42
Other specified uses not listed	1,470	7,440	5.07
Unspecified: 4/			
Actual	17,000	95,400	5.62
Estimated	2,870	15,700	5.48
Total	59,700	351,000	5.87

W Withheld to avoid disclosing company proprietary data; included with "Other specified uses not listed."
1/ Includes dolomite, granite, limestone, miscellaneous stone, sandstone and quartzite, slate, and traprock.
2/ Data are rounded to three significant digits except unit value; may not add to totals shown.
3/ Includes lightweight aggregate (slate), waste material, and other fine aggregate.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
VIRGINIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	965	5,350	W	W	W	W
Coarse aggregate, graded 3/	3,900	22,300	2,340	16,700	8,590	55,400
Fine aggregate (-3/8 inch) 4/	1,360	8,300	W	W	W	W
Coarse and fine aggregate 5/	4,400	21,200	2,510	15,700	7,850	40,800
Other construction materials 6/	210	987	1,370	9,050	3,030	19,600
Agricultural 7/	645	7,010	(8/)	(8/)	(8/)	(8/)
Chemical and metallurgical 9/	(8/)	(8/)	--	--	--	--
Special 10/	(8/)	(8/)	--	--	--	--
Unspecified: 11/						
Actual	2,630	17,600	(8/)	(8/)	(8/)	(8/)
Estimated	2,340	12,700	535	3,010	--	--
Total	19,100	112,000	9,210	59,700	31,500	180,000

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
6/ Includes lightweight aggregate (slate) and waste materials.
7/ Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes cement manufacture, chemical stone for alkali works, flux stone, glass manufacture, lime manufacture, and sulfur oxide removal.
10/ Includes asphalt fillers or extenders, mine dusting or acid water treatment, other fillers or extenders, whiting or whiting substitute, and other specified uses not listed.
11/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
VIRGINIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 2/	1,600	$8,900	$5.57
Concrete products (blocks, bricks, pipe, decorative, etc.)	149	1,000	6.71
Asphaltic concrete aggregates and other bituminous mixtures	687	3,360	4.90
Road base and coverings	450	1,220	2.71
Fill	1,220	2,840	2.33
Snow and ice control	44	217	4.93
Other miscellaneous uses 3/	195	929	4.76
Unspecified: 4/			
Actual	4,820	24,900	5.17
Estimated	621	2,420	3.90
Total or average	9,780	45,800	4.68

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes filtration.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
VIRGINIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	W	W	W	W	1,320	6,820
Asphaltic concrete and road base materials 3/	258	1,610	118	583	1,980	5,220
Snow and ice control	W	W	W	W	29	117
Other miscellaneous uses 4/	385	2,790	61	401	193	918
Unspecified: 5/						
Actual	19	92	--	--	4,800	24,800
Estimated	215	911	72	257	334	1,250
Total	877	5,410	251	1,240	8,650	39,100

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill.
4/ Includes filtration.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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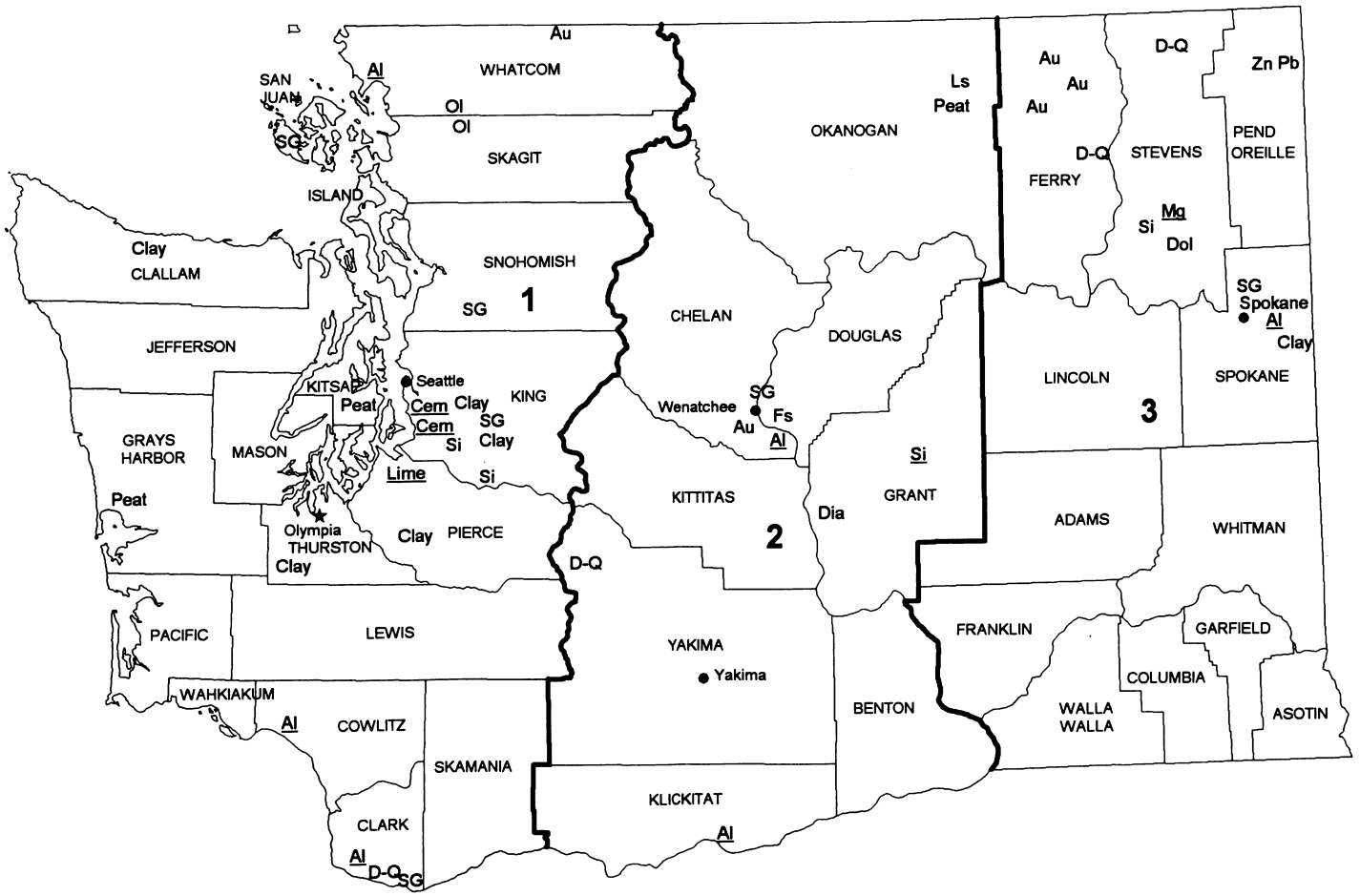
WASHINGTON



LEGEND

- State boundary
- County boundary
- ★ Capital
- ● City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Al	Aluminum plant
Au	Gold
Cem	Cement plant
Clay	Clay
CS	Crushed stone
D-Q	Dimension quartzite
Dia	Diatomite
Dol	Dolomite
Fs	Ferrosilic
Gyp	Gypsum
Lime	Lime plant
Ls	Limestone
Mg	Magnesium metal plant
Ol	Olivine
Pb	Lead
Peat	Peat
Si	Silica
Si	Silica plant
SG	Sand and gravel
Zn	Zinc

0 50 Kilometers

Source: Washington State Division of Geology and Earth Resources/U.S. Geological Survey

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THE MINERAL INDUSTRY OF WASHINGTON

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Washington State Division of Geology and Earth Resources for collecting information on all nonfuel minerals.

In 1997, Washington ranked 26th in the Nation in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The State was 23d in 1996. The estimated value for 1997 was $522 million, about a 2% decrease from that of 1996. This followed an 8.1% decrease from 1995 to 1996 (based on final 1996 data). The State accounted for almost 1.5% of the U.S. total nonfuel mineral production value.

Gold and magnesium metal, the only metals to be produced from Washington's natural resources, represented close to 30% of the State's nonfuel mineral value. About 65% of the State's industrial mineral value was accounted for by three commodities: construction sand and gravel, crushed stone, and portland cement, in descending order of value. In 1997, Washington's drop in value resulted mainly from the decreased value of magnesium metal, down more than $25 million, and gold, down by about $6 million. Increases in value occurred mostly in crushed stone, construction sand and gravel, and portland cement, but these were not enough to compensate for the drop in metal values, resulting in the State's net decrease (*table 1*). All other value changes were small. Only common clays, natural gemstones, crude gypsum, and industrial sand and gravel showed any decrease in value. In 1996, most of the State's drop in value resulted from decreases in portland cement, magnesium metal, and lime. Construction sand and gravel and crushed stone were the only nonfuel minerals to show any significant rise in value for the year.

Based on USGS estimates of the quantities produced in the 50 States in 1997, Washington remained second of 2 States that produce olivine; third of 3 magnesium metal-producing States; and fourth of 4 States that produce diatomite. The State rose to 9th from 10th in the production of gold and dropped from 6th to 7th in construction sand and gravel. In 1997, Washington continued to lead the Nation in the production of primary aluminum with an estimated 1.13 million metric tons, a nearly 2% increase from that of 1996. The State accounted for more than 31% of the U.S. total primary aluminum production. Raw steel was also produced in the State, both metals being processed from materials received from foreign and other domestic sources.

The following narrative information was provided by the Washington State Division of Geology and Earth Resources[2] (DGER). Production data in the following text are those reported by the DGER, based on the agency's own surveys and estimates. They may differ from some production figures reported to the USGS.

In the metallic mineral industry Echo Bay Minerals Co's. Kettle River Project mined and produced gold from the Lamefoot and K-2 deposits near Republic in Ferry County. Kettle River has been the only major gold mining operation in Washington for the past 2 years. In 1997, the Kettle River Project produced 4,040 kilograms of gold, up from the 3,890 kilograms produced in 1996. Recovery in 1997 was almost the same as in 1996 at about 85%. A total of more than 699,000 metric tons of ore was processed at the company's mill near Republic compared with 546,000 tons in 1996. Although tons of ore processed in 1997 was considerably higher than in 1996, the ore grade was lower.

Lamefoot, an exhalative/replacement-type deposit in Permian rocks, produced more than 494,000 tons of ore in 1997. K-2, an epithermal vein-type deposit in Eocene volcanic rocks (developed in 1996), produced 204,000 tons of ore in 1997. The remaining ore processed at the mill, 1,045 tons, was from a low-grade stockpile of ore mined prior to 1996 at the Overlook Mine. Approximately 80% of the ore mined in 1997 was replaced through discovery and confirmation of new reserves. Echo Bay Minerals also was one of the most active companies exploring in Washington in 1997. Echo Bay continued to explore at the Black Hawk property and added the Mires Creek property, both possible sites of mineralization similar to that at its Lamefoot deposit.

The environmental impact statement for Battle Mountain Gold Co.'s Crown Jewel gold deposit at Chesaw in Okanogan County was released in early February. The company was completing permit applications for the operation throughout 1997. If this process continued as smoothly as it had during 1997, Battle Mountain projected beginning construction of the mine and mill during 1998. Cominco American Inc., which had acquired the Pend Oreille Mine in 1996, continued its surface and underground exploration program at the property aimed at identifying reserves that could be shipped to its parent company's (Cominco Ltd.) smelter in Trail, British Columbia, Canada. The companies worked toward doing a feasibility study to determine how best to put the mine back into production. Startup could be sometime after closure of the parent company's Sullivan Mine in nearby

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html . All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Robert E. Derkey, Geologist, authored the text of mineral industry information submitted by the Washington State Division of Geology and Earth Resources.

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British Columbia.

Northwest Alloys Inc. (a subsidiary of Aluminum Co. of America) continued to produce magnesium metal at its plant near Addy in Stevens County. The amount of dolomite mined adjacent to the plant that was crushed, calcined, and sent to the reactor, decreased slightly in 1997, to 483,000 tons compared with 532,000 tons in 1996.

A new company active for the first time in Washington in 1997 was Spokane-based Yamana Resources Inc. The company drilled 18 holes at the Palmer Mountain property in north central Washington for potential volcanogenic massive sulfide mineralization. Yamana also drilled for gold at the Blue Lake and Schuer Bet properties in 1997.

At the Wind River Mine in Skamania County, DeLano Wind River Mining Co. was driving a drift to intercept the currently-mined vein at a lower level and was modifying the mill through the addition of a flotation circuit to recover the gold-bearing minerals. The company also continued to mine and stockpile ore from the Wind River gold deposit. DeLano hopes mill modification will allow them to obtain permits to establish the milling operation.

In industrial mineral industry activities, companies that mined limestone and dolomite for use as a soil conditioner and/or as feed lime included Pacific Calcium Inc. from its Tonasket and Brown quarries in Okanogan County; Allied Minerals, Inc. from its Gehrke quarry; and Northwest Alloys where calcium-magnesium lime is a feedstock for magnesium metal production at Addy in Stevens County. Columbia River Carbonates continued to produce high brightness calcium carbonate mined from the Wauconda quarry in Ferry County and process it for the paper industry in Longview, Cowlitz County. Northport Limestone Co. mined and shipped carbonate from its Sherve quarry in Stevens County, most of which was shipped to Trail, British Columbia, where it was used as a fluxing agent in smelting. Northwest Marble Products produced color- and site-specific carbonate products for terrazzo tile and related products.

As estimated and reported by the DGER, Olivine Corp. produced approximately 36,000 tons of olivine in 1997 from its Sven Larsen quarry in Whatcom County. The company used about 900 tons of its production for refractory materials for waste incinerators, and the remaining production was shipped as crushed olivine to Unimin Corp. to produce casting sands and other refractory products at Hamilton in Skagit County.

Holnam Inc. and Ash Grove Cement Co. mined clay and silica in western Washington for the cement industry. Holnam Inc. mined clay from the Twin River quarry in Clallam County, and Ash Grove Cement Co. mined clay from its Castle Rock quarry Cowlitz County and silica from its Superior quarry in King County. Pacific Coast Coal Co. also mined clay from the John Henry #1 coal mine in King County and shipped it to Ash Grove Cement Co.

Clay used predominantly for bricks and related products was mined by Mutual Materials in Spokane County at the Potratz Mine in King County at the Elk and Section 31 pits and from the Clay City pit in Pierce County.

The DGER also reported the estimated mineral production for several other companies. Celite Corp. mined and processed 95,300 tons of diatomite at its pits in Grant County. The company produced 65,300 tons of finished diatomite. Lane Mountain Silica Co. mined 272,000 tons of Addy Quartzite from the Lane Mountain quarry in Stevens County. Following processing, the company shipped 209,000 tons of high-purity quartz, most of which was used to manufacture clear glass bottles and jars. Reserve Silica Corp. mined 63,500 tons of quartz-rich Puget Group sands (industrial sand) from the Ravensdale pit in King County. Most of Reserve's production is used for the manufacture of colored bottle glass.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN WASHINGTON 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement, portland	W	W	1,160	78,900 e/	1,180	82,100 e/
Clays, common	220	1,040	218	1,070	207	956
Gemstones	NA	53	NA	36	NA	34
Gypsum, crude	--	--	W	W	9	63
Peat metric tons	2	87	W	W	W	W
Sand and gravel, construction	37,700	155,000	37,900	162,000	38,900	170,000
Stone, crushed	15,800 3/	76,800 3/	15,400	81,400	17,000	90,100
Combined value of cement (masonry), diatomite, gold, lime, magnesium metal, olivine, sand and gravel (industrial), stone [crushed dolomite, limestone, and marble (1995), dimension miscellaneous], and values indicated by symbol W	XX	350,000	XX	212,000	XX	179,000
Total	XX	582,000	XX	535,000	XX	522,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Excludes certain stones; kind and value included with "Combined value" data.

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TABLE 2
WASHINGTON: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone 2/	7 3/	1,220 3/	$19,200 3/	$15.77 3/	8	2,140	$21,900	$10.24
Dolomite	5	W	W	4.14	2	W	W	4.61
Granite	8 r/	242 r/	991 r/	4.10 r/	5	257	1,310	5.10
Traprock	133	12,100	47,000	3.88	99	11,000	49,000	4.46
Sandstone	5	W	W	3.96	5	W	3,290	W
Slate	1	W	W	3.93	5	W	W	4.72
Marble	(4/)	(4/)	(4/)	(4/)	--	--	--	--
Miscellaneous stone	13	802	3,440	4.28	11	910	4,110	4.51
Total	XX	15,800	76,800	4.85	XX	15,400	81,400	5.27

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits except unit value; may not add to totals shown.
2/ Includes limestone-dolomite, reported with no distinction between the two.
3/ Excludes limestone-dolomite from State total to avoid disclosing company proprietary data.
4/ Excludes marble from State total to avoid disclosing company proprietary data.

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TABLE 3
WASHINGTON: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	W	W	$7.23
Riprap and jetty stone	707	$4,230	5.98
Filter stone	74	460	6.22
Other coarse aggregate	W	W	6.18
Coarse aggregate, graded:			
Bituminous aggregate, coarse	212	1,030	4.87
Bituminous surface-treatment aggregate	150	765	5.10
Railroad ballast	73	432	5.92
Fine aggregate (-3/8 inch):			
Stone sand, concrete	W	W	3.48
Stone sand, bituminous mix or seal	W	W	3.60
Screening, undesignated	36	142	3.94
Coarse and fine aggregates:			
Graded road base or subbase	927	2,940	3.17
Unpaved road surfacing	944	3,040	3.22
Terrazzo and exposed aggregate	W	W	7.87
Crusher run or fill or waste	57	167	2.93
Other construction materials	261	1,840	7.07
Agricultural:			
Agricultural limestone	22	267	12.14
Poultry grit and mineral food	(3/)	(3/)	3.83
Chemical and metallurgical:			
Cement manufacture	(3/)	(3/)	5.09
Lime manufacture	(3/)	(3/)	15.00
Dead-burned dolomite manufacture	145	557	3.84
Special:			
Whiting or whiting substitute	(3/)	(3/)	126.57
Other fillers or extenders	(3/)	(3/)	88.50
Paper manufacture	(3/)	(3/)	194.50
Unspecified: 4/			
Actual	4,560	23,600	5.19
Estimated	7,100	29,900	4.21
Total	15,400	81,400	5.27

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Includes dolomite, granite, limestone, limestone-dolomite, miscellaneous stone, sandstone, slate, traprock, and volcanic cinder and scoria.
2/ Data are rounded to three significant digits except unit value; may not add to totals shown.
3/ Withheld to avoid disclosing company proprietary data; included in "Total."
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
WASHINGTON: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District unspecified	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 2/	868	5,330	W	W	W	W	–	–
Coarse aggregate, graded 3/	W	W	W	W	189	774	–	--
Fine aggregate (-3/8 inch) 4/	W	W	W	W	W	W	--	--
Coarse and fine aggregate 5/	1,660	5,150	W	W	W	W	–	--
Other construction materials	282	1,680	226	1,320	222	798	--	--
Agricultural 6/	--	--	(7/)	(7/)	(7/)	(7/)	--	--
Chemical and metallurgical 8/	(7/)	(7/)	--	--	(7/)	(7/)	--	--
Special 9/	--	--	(7/)	(7/)	--	--	–	--
Unspecified: 10/								
Actual	(7/)	(7/)	1,190	3,630	(7/)	(7/)	--	--
Estimated	5,230	21,800	515	2,340	1,160	4,540	195	1,170
Total	9,930	47,600	2,020	18,900	3,290	13,700	195	1,170

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes bituminous aggregate (coarse), bituminous surface-treatment aggregate, and railroad ballast.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), and screening (undesignated).
5/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, and crusher run (select material or fill).
6/ Includes agricultural limestone and poultry grit and mineral food.
7/ Withheld to avoid disclosing company proprietary data; included in "Total."
8/ Includes cement manufacture, dead-burned dolomite manufacture, and lime manufacture.
9/ Includes other fillers or extenders, paper manufacture,and whiting or whiting substitute.
10/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
WASHINGTON: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	10,200	$50,900	$5.00
Plaster and gunite sands	14	117	8.36
Concrete products (blocks, bricks, pipe, decorative, etc.)	114	804	7.05
Asphaltic concrete aggregates and other bituminous mixtures	1,860	8,030	4.31
Road base and coverings 2/	5,790	25,200	4.35
Fill	5,190	16,500	3.18
Snow and ice control	199	786	3.95
Railroad ballast	93	498	5.35
Other miscellaneous uses	792	2,730	3.45
Unspecified: 3/			
Actual	4,950	19,200	3.89
Estimated	8,710	37,200	4.27
Total or average	37,900	162,000	4.27

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
WASHINGTON: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	7,400	43,200	W	W	W	W
Asphaltic bituminous mixtures	1,540	6,950	217	712	104	363
Road base and coverings 3/	4,790	21,500	337	1,410	666	2,300
Fill	5,110	16,200	63	210	19	73
Snow and ice control	156	625	W	W	W	W
Railroad ballast	81	472	2	5	11	21
Other miscellaneous uses	710	2,490	911	3,230	2,120	5,870
Unspecified: 4/						
Actual	2,850	11,400	556	2,330	1,540 5/	5,470 5/
Estimated	6,070	27,800	1,960	7,340	683	1,990
Total	28,700	131,000	4,040	15,200	5,150 5/	16,100 5/

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement and lime).
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.
5/ Includes production within State with no district reported.

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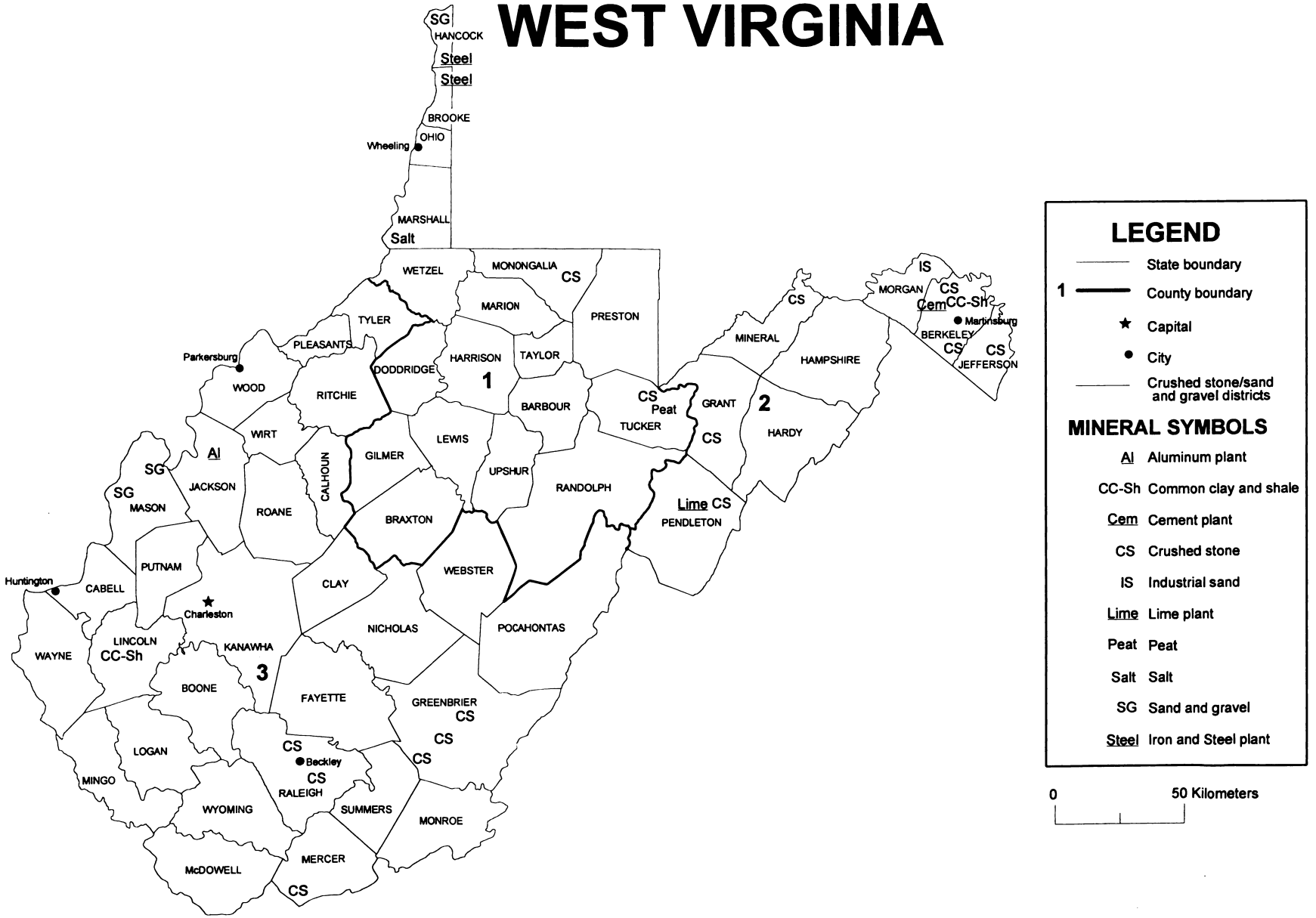
WEST VIRGINIA



LEGEND

- State boundary
- 1 County boundary
- ★ Capital
- ● City
- Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Al	Aluminum plant
CC-Sh	Common clay and shale
Cem	Cement plant
CS	Crushed stone
IS	Industrial sand
Lime	Lime plant
Peat	Peat
Salt	Salt
SG	Sand and gravel
Steel	Iron and Steel plant

0 50 Kilometers

Source: West Virginia Geological and Economic Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF WEST VIRGINIA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the West Virginia Geological and Economic Survey for collecting information on all nonfuel minerals.

In 1997, for the third consecutive year, West Virginia ranked 40th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $190 million, about a 3% increase from that of 1996. This followed a 2.2% increase from 1995 to 1996 (based on final 1996 data). The State accounted for 0.5% of the U.S. total nonfuel mineral production value.

Crushed stone and portland cement were West Virginia's two leading nonfuel minerals. The rise in the State's nonfuel mineral value in 1997 resulted from increases in crushed stone (including crushed dolomite), portland cement, and construction sand and gravel, in descending order of relative increase (*table 1*). All other nonfuel minerals showed small increases in value except for small decreases that occurred in common clays and peat; industrial sand and gravel and gemstones remained unchanged. In 1996, increases in the values of lime, crushed limestone, masonry cement, and crushed dolomite (descending order of relative increase) more than compensated for a 17% drop in the value of portland cement, resulting in the State's net increase.

Based on USGS estimates of the quantities of minerals produced in the 50 States in 1997, West Virginia remained 9th in salt. West Virginia mines produced only industrial minerals and coal; no metals were mined in the State. Primary aluminum and raw steel were produced in West Virginia, but both metals were processed from materials acquired from foreign and other domestic sources. West Virginia was 12th in the Nation in primary aluminum production in 1997.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN WEST VIRGINIA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays, common	184	365	199	369	169	338
Gemstones	NA	1	NA	1	NA	1
Sand and gravel, construction	1,800	7,650	1,730	7,710	1,830	8,330
Stone, crushed 3/	11,800	75,000	12,700	78,400	12,600	79,000
Combined value of cement, lime, peat, salt, sand and gravel (industrial), stone [crushed dolomite, dimension sandstone]	XX	97,700	XX	98,600	XX	102,000
Total	XX	181,000	XX	185,000	XX	190,000

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, or marketable production (including comsumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined value" data.

TABLE 2
CRUSHED STONE SOLD OR USED BY PRODUCERS IN WEST VIRGINIA, BY KIND 1/ 2/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	38	10,800	$68,800	$6.36	36	11,900	$72,400	$6.10
Sandstone	10	934	6,170	6.61	9	851	5,970	7.02
Total	XX	11,800	75,000	6.38	XX	12,700	78,400	6.16

XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excludes dolomite from State total to avoid disclosing company proprietary data.

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TABLE 3
WEST VIRGINIA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	52	$514	$9.88
Riprap and jetty stone	418	2,250	5.38
Filter stone	169	985	5.83
Other coarse aggregate	59	364	6.17
Coarse aggregate, graded:			
Concrete aggregate, coarse	550	3,340	6.07
Bituminous aggregate, coarse	609	3,220	5.28
Bituminous surface-treatment aggregate	311	1,950	6.27
Railroad ballast	62	380	6.13
Other graded coarse aggregate	1,170	7,070	6.02
Fine aggregate (-3/8 inch):			
Stone sand, concrete	135	783	5.80
Stone sand, bituminous mix or seal	315	1,760	5.58
Screening, undesignated	51	296	5.80
Coarse and fine aggregates:			
Graded road base or subbase	467	2,570	5.51
Unpaved road surfacing	146	956	6.55
Crusher run or fill or waste	1,120	5,510	4.90
Other construction materials 3/	71	360	5.07
Agricultural limestone	8	67	8.38
Chemical and metallurgical:			
Cement manufacture	1,120	1,530	1.37
Sulfur oxide removal	13	68	5.23
Special, mine dusting or acid water treatment	86	2,090	24.30
Unspecified: 4/			
Actual	5,150	38,400	7.45
Estimated	1,790	11,000	6.11
Total	12,700	78,400	6.16

1/ Includes limestone and sandstone, excludes dolomite from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes other graded coarse aggregate.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
WEST VIRGINIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	223	769	243	1,910	234	1,440
Coarse aggregate, graded 4/	336	1,900	W	W	W	W
Fine aggregate (-3/8 inch) 5/	72	504	W	W	W	W
Coarse and fine aggregate 6/	498	2,420	510	2,930	729	3,690
Other construction materials	–	–	571	3,710	1,130	5,970
Agricultural 7/	5	39	(8/)	(8/)	(8/)	(8/)
Chemical and metallurgical 9/	–	–	1,130	1,600	–	–
Special 10/	86	2,090	–	–	–	–
Unspecified: 11/						
Actual	3,600	26,300	462	4,810	1,090	7,290
Estimated	662	4,660	(8/)	(8/)	(8/)	(8/)
Total	5,480	38,700	3,540	18,600	3,690	21,100

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Excludes dolomite from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), and screening (undesignated).
6/ Includes graded road base or subbase, unpaved road surfacing and cursher run (select material or fill).
7/ Includes agricultural limestone.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes cement manufacture and sulfur oxide removal.
10/ Includes mine dusting or acid water treatment.
11/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
WEST VIRGINIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products 3/	527	$2,450	$4.64
Asphaltic concrete aggregates and other roadbase material 4/	315	1,190	3.77
Unspecified, actual 5/	892	4,070	4.57
Total or average	1,730	7,710	4.44

1/ To avoid disclosing company proprietary data, no district tables were produced for 1996.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Includes fill.
5/ Production reported without a breakdown by end use.

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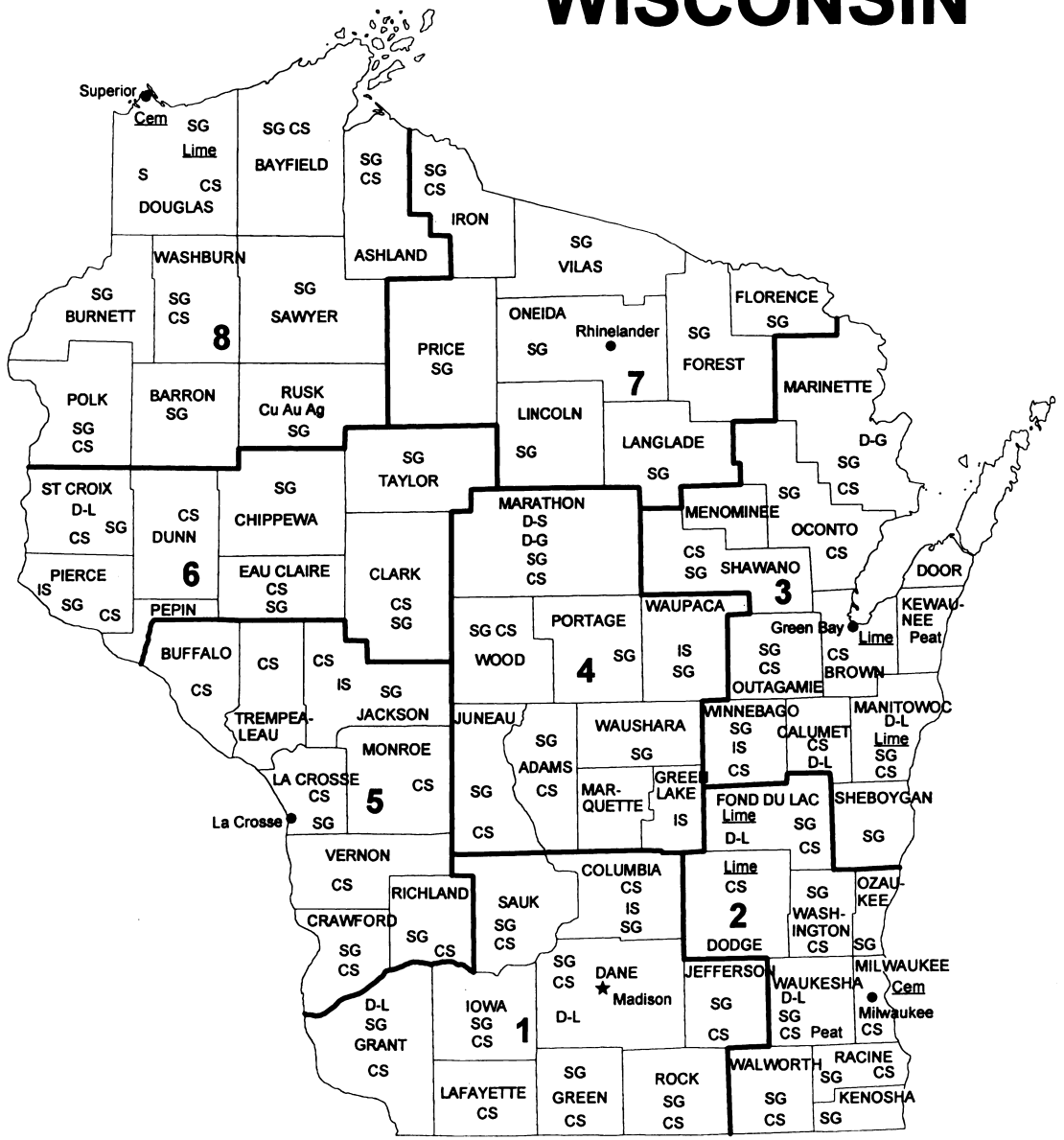
WISCONSIN



LEGEND

- State boundary
- County boundary
- ★ Capital
- ● City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Ag	Silver
Au	Gold
Cu	Copper
Cem	Cement plant
CS	Crushed stone
D-G	Dimension granite
D-L	Dimension limestone
D-S	Dimension sandstone
IS	Industrial sand
Lime	Lime plant
Peat	Peat
SG	Sand and gravel
S	Sulfur (recovered)

0 50 Kilometers

Source: Wisconsin Geological and Natural History Survey/U.S. Geological Survey

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THE MINERAL INDUSTRY OF WISCONSIN

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Wisconsin Geological and Natural History Survey for collecting information on all nonfuel minerals.

In 1997, Wisconsin ranked 34th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The State was 32d in 1996. The estimated value for 1997 was $389 million, a decrease of almost 2% from that of 1996. This followed a 4.8% decrease from 1995 to 1996 (based on final 1996 data). The State accounted for 1% of the U.S. total nonfuel mineral production value.

Crushed stone and construction sand and gravel were, by value, Wisconsin's leading nonfuel minerals in 1997, accounting for 33% and 29%, respectively, of the State's total nonfuel mineral value. Copper was third; all Wisconsin metal mine production—copper, gold, and silver—equaled about 17% of the State's total. In 1997, the combined increases of more than $15 million in the value of crushed stone, and about $6 million and $2 million in construction and industrial sand and gravel, respectively, were not enough to offset a significant drop in the production and value of copper and smaller decreases in gold and silver values. In 1996, a substantial drop in the value of copper accounted for most of Wisconsin's decrease. The largest increases that year occurred in the values of crushed stone, construction sand and gravel, and dimension stone (*table 1*).

Based on USGS estimates of quantities of minerals produced in the 50 States for 1997, Wisconsin remained second in dimension stone and second of 2 States that produce silica stone, and fifth in industrial sand and gravel. The State rose to 11th from 12th of the 13 gold-producing States and dropped from 8th to 9th in construction sand and gravel. Additionally, significant quantities of crushed stone and lime were produced in the State.

The following narrative information was provided by the Wisconsin Geological and Natural History Survey (WGNHS).[2] In general, the year was marked by significant activity regarding both metallic and nonmetallic mining. Metallic mineral development highlights included the cessation of mining at the Flambeau Mine, the ongoing permitting evaluation for the Crandon Mine proposal, the reduced levels of mineral exploration and leasing, and the intense public debate over a proposed mining "moratorium" bill. The adoption of revised statutory language to allow for the enactment of new, negotiated administrative rules related to the reclamation of nonmetallic mines was the principal focus of nonmetallic mineral development activity.

Metallic mineral exploration totaled only 10 drill holes during the year. In addition, the level of leasing activity for metallic minerals was at the lowest level since the recording of such leases became mandatory in 1978. The majority of the exploration and leasing activity during the year was related to Flambeau Mining Co.'s evaluation of possible metallic mineral occurrences in west-central Wisconsin, particularly in Clark, Jackson, and Trempealeau Counties. Other companies drilling in 1997 (one hole each) were Sharpe Energy & Resources and BHP Minerals. At yearend, BHP had released most of its acreage under lease in the State and closed its Rhinelander office. Sharpe Energy & Resources continued its interest in the Bend Deposit in Taylor County within the Chequamegon National Forest near Perkinstown.

Crandon Mining Company (CMC), an equity partnership between Exxon Minerals Co. (50%) and Rio Algom Ltd. (50%), continued permitting activities during the year focusing on the evaluation of potential impacts of their joint project on the local groundwater and surface water systems in the immediate area of the companies' proposed underground mine. This area is located 3 miles south of the city of Crandon in Forest County. Over the course of the year, CMC continued to develop and sign agreements with the local governmental bodies in the area, though efforts to pursue agreements with Oneida County and the town of Crescent regarding the development and routing of the proposed wastewater pipeline from the mine were on hold. The Crandon Project is proposed to be a 4,990-ton-per-day zinc-copper mine for development of the 50-million-ton massive sulfide ore body initially discovered in 1975 and announced in 1976 by the former Exxon Coal and Minerals Co. Public discussion regarding the mine continued throughout 1997 with respect to the proposed 61-kilometer treated wastewater pipeline; the construction of a Tailings Management Area to contain 40 million tons of sulfidic tailings; and the transfer of groundwater resources out of the Great Lakes watershed into the Wisconsin River, a part of the Mississippi River watershed.

The Flambeau Mine, operated by Flambeau Mining Co., a subsidiary of Kennecott Corporation, ceased the production of copper ore from the small open-pit mine located in Rusk County, south of the city of Ladysmith (Skillings Mining Review, 1997). Total production from the property since its opening in May 1993 is 1,720,000 metric tons of ore averaging 8.9% copper and 3.43 grams per ton gold. Three different ores were produced—about 363,000 tons of direct smelting copper ore, 136,000 tons of gold-bearing gossan ore, and the rest being a copper milling ore. The

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/ contacts/comdir.html . All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Thomas Evans, a Geologist with the WGNHS, authored the text of information submitted by that agency.

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363,000 tons of direct smelting copper ore, 136,000 tons of gold-bearing gossan ore, and the rest being a copper milling ore. The direct smelting ore and the gossan were processed at Noranda's Horne smelter in Rouyn, Quebec, and the copper milling ore was sent to Falconbridge's facilities in Timmins, Ontario. The company estimates that 1.8 to 2.7 million tons, averaging 2% to 3% copper, remain below the 69-meter maximum depth of the open pit. The open pit has been filled with waste rock as part of the final reclamation of the site.

For the company's more than 4 years of operation the Flambeau Mine employed an average of about 70 persons. In accord with a local agreement, at least 75% of these employees were from the local Rusk County area. Reclamation of the site continues with the objective of returning the site to low-intensity wildlife management. Discussions with local officials regarding alternative uses of the buildings on the site and other potential uses of the site are continuing.

Legislation and Government Programs

The Wisconsin State Governor issued Executive Order #309 naming a Scientific Advisory Council on Metallic Mining, which had been authorized in the Budget bill for the fiscal year (FY) 1997-98 biennium. The five-member council is directed to evaluate proposed mining technologies for metallic mining projects and to make recommendations regarding the effectiveness and feasibility of implementing technologies proposed to be used by metal mines in the State. Such recommendations are to be included in environmental impact statements developed for proposed mining projects.

In 1997, significant public debate and legislative activity focused on Senate bill 3, which was characterized as the mining moratorium bill. The bill would create an additional condition related to the issuance or rejection of a metallic mineral operating permit, such that an applicant for such a permit must demonstrate that a similar mine has operated for at least 10 years. Additionally, the bill would provide that a similar mine has been reclaimed for at least 10 years without causing environmental pollution. The bill generated considerable controversy and was passed by the Legislature in early 1998, after clarification of the types of mines that could be used by potential applicants for mine permits and the meaning of the term "pollution." The bill was then forwarded to the Governor for signature.

The Budget bill for the FY 1997-98 biennium contained Act 27, which included statutory language creating the authority for a statewide nonmetallic mining reclamation requirement. The statutory language was needed to allow promulgation of proposed NR 135, an administrative rule that had been developed and negotiated among several parties, including environmental groups, local governmental officials, and industry representatives. The technical advisory committee to the (now former) Nonmetallic Mining Council was the principal vehicle used to develop these revised rules, which was needed following significant adverse reaction to a previous draft version of NR 135 that had gone out for public hearings. The Nonmetallic Mining Council was disbanded in the same Budget bill by 1997 Wisconsin Act 2.

Reference Cited

Skillings Mining Review, 1997, Flambeau Mining Co. Completes Four Years of Production at Ladysmith Copper/Gold Mine, v. 86, no. 36, September 6, pp. 4-6.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN WISCONSIN 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Gemstones	NA	65	NA	505	NA	927
Lime	568	33,900	551	32,000	557	32,400
Sand and gravel:						
Construction	32,200	102,000	32,600	105,000	33,500	111,000
Industrial	1,670	33,300	1,660	32,300	1,730	34,400
Stone:						
Crushed	26,000	108,000	26,000	113,000	29,000	128,000
Dimension metric tons	128,000	14,500	143,000	16,600	144,000	16,700
Combined value of copper, gold, peat, silica stone (1995-96), silver	XX	124,000	XX	96,800	XX	65,200
Total	XX	416,000	XX	396,000	XX	389,000

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 2
CRUSHED STONE SOLD OR USED BY PRODUCERS IN WISCONSIN, BY KIND 1/

Kind	1995 Number of quarries	1995 Quantity (thousand metric tons)	1995 Value (thousands)	1995 Unit value	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value
Limestone 2/	171 r/	21,100 r/	$88,700 r/	$4.20 r/	167	20,800	$92,600	$4.45
Dolomite	2 r/	100 r/	435 r/	4.35 r/	3	263	1,400	5.31
Granite	9	1,210	3,110	2.58	6	1,350	2,690	2.00
Traprock	3	1,970	8,980	4.56	3	W	W	4.68
Sandstone and quartzite	3	1,560	6,800	4.35	4	W	W	4.39
Total	XX	26,000	108,000	4.16	XX	26,000	113,000	4.34

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes "limestone-dolomite," reported with no distinction between the two.

TABLE 3
WISCONSIN: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	98	$553	$5.64
Filter stone	150	725	4.83
Other coarse aggregate 3/	935	4,540	4.86
Coarse aggregate, graded:			
Concrete aggregate, coarse	1,350	7,080	5.23
Bituminous aggregate, coarse	445	2,510	5.63
Bituminous surface-treatment aggregate	163	616	3.78
Railroad ballast	40	239	5.98
Other graded coarse aggregate	48	239	4.98
Fine aggregate (-3/8 inch):			
Stone sand, concrete	14	61	4.36
Screening, undesignated	533	1,950	3.65
Other fine aggregate 4/	43	191	4.44
Coarse and fine aggregates:			
Graded road base or subbase	7,400	29,800	4.03
Unpaved road surfacing	996	1,960	1.96
Crusher run or fill or waste	407	1,400	3.43
Other coarse and fine aggregates	140	617	4.41
Other construction materials 5/	491	2,740	5.58
Agricultural:			
Agricultural limestone	381	4,080	10.70
Other agricultural uses	W	W	3.17
Chemical and metallurgical:			
Lime manufacture	W	W	3.97
Flux stone	28	138	4.93
Special:			
Other fillers or extenders	16	87	5.44
Other specified uses not listed	W	W	3.00
Unspecified: 6/			
Actual	6,250	28,500	4.56
Estimated	5,880	24,100	4.09
Total	26,000	113,000	4.34

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, granite, limestone, limestone-dolomite, sandstone and quartzite, and traprock.
2/ Data are rounded to three significant digits except unit values; may not add to totals shown.
3/ Includes macadam.
4/ Includes stone sand (bituminous mix or seal).
5/ Includes roofing granules and terrazzo and exposed aggregate.
6/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
WISCONSIN: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1996,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	52	175	W	W	W	W
Coarse aggregate, graded 4/	145	606	W	W	489	1,860
Fine aggregate (-3/8 inch) 5/	65	200	W	W	W	W
Coarse and fine aggregate 6/	3,060	13,100	2,180	9,410	2,400	9,290
Other construction materials 7/	2	5	2,560	13,800	344	1,080
Agricultural 8/	140	856	(9/)	(9/)	(9/)	(9/)
Chemical and metallurgical 10/	--	--	(9/)	(9/)	(9/)	(9/)
Special 11/	(9/)	(9/)	--	--	(9/)	(9/)
Unspecified: 12/						
Actual	(9/)	(9/)	809	3,880	77	322
Estimated	1,550	6,750	703	2,830	2,100	7,940
Total	5,500	24,100	6,430	32,600	5,620	21,400

	District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	W	W	W	W	W	W
Coarse aggregate, graded 4/	W	W	W	W	54	264
Fine aggregate (-3/8 inch) 5/	--	--	20	42	--	--
Coarse and fine aggregate 6/	1,370	2,870	W	W	W	W
Other construction materials 7/	44	233	404	1,780	78	420
Agricultural 8/	--	--	(9/)	(9/)	40	357
Chemical and metallurgical 10/	--	--	--	--	--	--
Special 11/	--	--	--	--	--	--
Unspecified: 12/						
Actual	1,440	6,110	(9/)	(9/)	594	2,630
Estimated	155	701	37	169	1,340	5,680
Total	3,010	9,910	3,350	15,500	2,100	9,350

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Production reported in District 8 was included with "District 6" to avoid disclosing company proprietary data; no Crushed Stone was produced in District 7.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aaggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
7/ Includes roofing granules.
8/ Includes agricultural limestone and other agricultural uses.
9/ Withheld to avoid disclosing company proprietary data; included in "Total."
10/ Includes flux stone and lime manufacture.
11/ Includes other fillers or extenders and other specified uses not listed.
12/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 5
WISCONSIN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	7,470	$29,300	$3.93
Plaster and gunite sands	32	210	6.56
Concrete products (blocks, bricks, pipe, decorative, etc.)	376	2,010	5.35
Asphaltic concrete aggregates and other bituminous mixtures	1,660	4,900	2.96
Road base and coverings 2/	5,420	17,200	3.18
Fill	1,440	2,550	1.78
Snow and ice control	158	524	3.32
Other miscellaneous uses 3/	270	1,260	4.67
Unspecified: 4/			
Actual	7,990	26,200	3.27
Estimated	7,780	21,000	2.70
Total or average	32,600	105,000	3.22

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes filtration, railroad ballast, and roofing granules.
4/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 6
WISCONSIN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	1,290	5,550	3,830	14,900	1,090	4,020
Asphaltic/ bituminous mixtures	W	W	183	719	225	509
Road base and coverings 3/	W	W	2,000	7,720	494	1,340
Fill	170	420	604	1,270	W	W
Snow and ice control	8	31	16	77	W	W
Other miscellaneous uses 4/	653	2,190	138	543	139	309
Unspecified: 5/						
Actual	1,430	4,890	4,870	15,900	65	206
Estimated	571	1,780	2,120	5,500	1,820	4,730
Total	4,120	14,900	13,800	46,600	3,840	11,100

	District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	194	1,250	W	W	654	2,460
Asphaltic/ bituminous mixtures	98	305	W	W	230	661
Road base and coverings 3/	336	1,020	102	169	896	2,610
Fill	280	353	--	--	207	236
Snow and ice control	5	35	W	W	54	89
Other miscellaneous uses 4/	--	--	80	238	29	101
Unspecified: 5/						
Actual	344	758	191	628	--	--
Estimated	379	1,150	72	227	884	2,720
Total	1,640	4,870	445	1,260	2,950	8,880

	District 7		District 8	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	W	W	588 6/	2,570 6/
Asphaltic bituminous mixtures	W	W	603 6/	1,950 6/
Road base and coverings 3/	W	W	871 6/	2,350 6/
Fill	W	W	52	84
Snow and ice control	32	80	17	71
Other miscellaneous uses 4/	641	1,760	7	42
Unspecified: 5/				
Actual	--	--	1,090 6/	3,780 6/
Estimated	728	2,020	1,200	2,880
Total	1,400	3,860	4,430 6/	13,700 6/

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement and lime).
4/ Includes filtration, railroad ballast, and roofing granules.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.
6/ Includes production within the State with no district reported.

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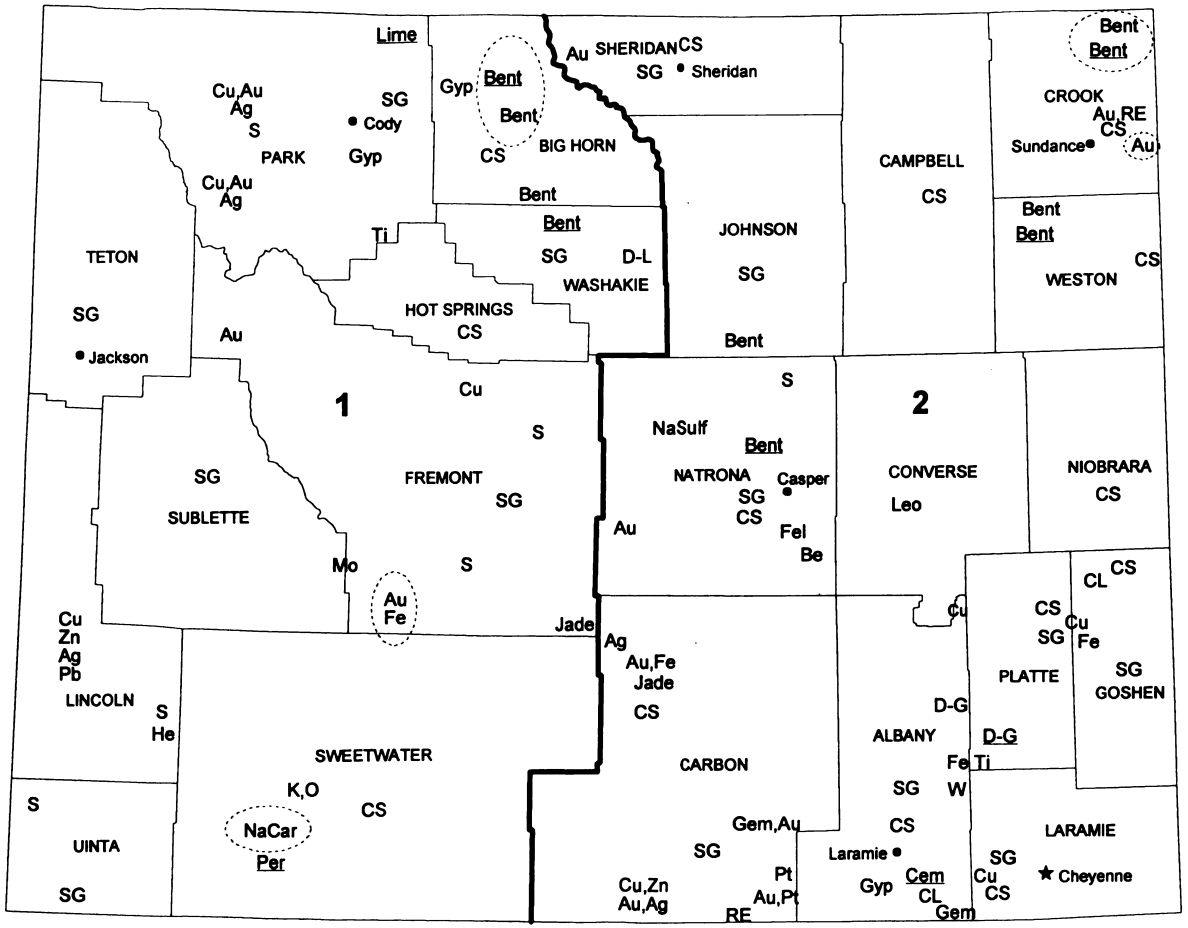

Metals exploration activities are included on this map.

LEGEND

- State boundary
- County boundary
- ★ Capital
- • City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

Ag	Silver
Au	Gold
Be	Beryllium
Bent	Bentonite
Bent	Bentonite mill
Cem	Cement plant
CL	Crushed limestone
CS	Crushed stone
Cu	Copper
D-G	Dimension granite
D-G	Dimension granite plant
D-L	Dimension limestone
Fe	Iron
Fel	Feldspar
Gem	Diamonds
Gyp	Gypsum
He	Helium
Jade	Jade
K	Potash
Leo	Leonardite
Lime	Lime plant
Mo	Molybdenum
NaCar	Sodium carbonate
NaSulf	Sodium sulfate
O	Olivine
Per	Perlite plant
Pt	Platinum group metals
Pb	Lead
RE	Rare earths
S	Sulfur
SG	Sand and gravel
Ti	Titanium
W	Tungsten
Zn	Zinc
⬭	Concentration of mineral operations

0 — 100 Kilometers

Source: Geological Survey of Wyoming/U.S. Geological Survey

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THE MINERAL INDUSTRY OF WYOMING

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Geological Survey of Wyoming for collecting information on all nonfuel minerals.

In 1997, for the second consecutive year, Wyoming ranked 12th among the 50 States in total nonfuel mineral production value,[1] according to the U.S. Geological Survey (USGS). The estimated value for 1997 was $996 million, a decrease of less than 8% from that of 1996. This followed a 10.9% increase from 1995 to 1996 (based on final 1996 data). The State accounted for 2.5% of the U.S. total nonfuel mineral production value.

Wyoming's leading nonfuel mineral, by value, was soda ash, followed by bentonite, grade-A helium, and portland cement. In 1997, a significant decrease in the value of soda ash accounted for virtually all of the State's drop in value (*table 1*). Portland cement, grade-A helium, and lime showed small increases; all other mineral commodities slightly decreased or remained unchanged. In 1996, an increase in the value of soda ash (nearly equal to the commodity's 1997 decrease) accounted for a large majority of Wyoming's substantial increase in value. Lime, portland cement, and bentonite values (and less so those of crushed stone and crude helium) contributed to the State's large rise in value.

Based on USGS estimates of the quantities of minerals produced in the 50 States during 1997, Wyoming remained first in soda ash and bentonite, second in Grade-A helium, and sixth in zeolites. Soda ash (sodium carbonate) is an inorganic chemical extensively used in the manufacture of glass, paper, soap and detergents, textiles, and as sodium bicarbonate in food products. The United States is the world's largest producer of soda ash. Wyoming, one of only two producing States, is home to the world's largest known natural deposit of trona. Trona is the principal ore from which soda ash is refined. California produces a significantly smaller quantity of natural soda ash. Wyoming has not had significant metal production since iron ore mining ceased in April 1984.

The following narrative information was provided by the Wyoming State Geological Survey[2] (WSGS). During 1997, the Wyoming minerals industry continued to show considerable interest in gemstones (especially diamond), metals, industrial minerals, and uranium.

Exploration efforts in the State were varied. At least three companies continued to explore for diamond in the Green River Basin in southwestern Wyoming. One of these companies, Guardian Enterprises, reported finding another cryptovolcanic (has circular structure with brecciation of unknown, though presumed volcanic, origin) breccia pipe 0.8 kilometer north of its 1996 discovery near Cedar Mountain. A total of 11 pipes have now been found by the company. One of these, the DK pipe, yielded three gem-quality diamonds during drilling in 1996. Further north, Guardian reported finding 48 diamonds in an alluvial source. Guardian also identified several circular to elongate magnetic anomalies northeast of the Cedar Mountain pipes, which suggests the presence of a second cluster of pipes.

At the Kelsey Lake diamond mine in the State Line district in northern Colorado and southeastern Wyoming, Redaurum Limited continued to recover large diamonds including a 28.18 carat gemstone. This diamond was cut into a 16.8 carat gem (Denver Post, 1997). In a surprise development, Redaurum placed Kelsey Lake, along with its two African diamond mines, up for sale (Northern Miner, 1997). Kelsey Lake has been producing 65% gemstones (about 50% weighing greater than 1 carat) and 35% industrial stones.

In central Wyoming, a cryptovolcanic structure was drilled in the Seminoe Mountains and some exploration was reported along the flank of the Bighorn Mountains where G10 (diamond inclusion) pyropes have been reported. Other diamond exploration activities were reported in the Iron Mountain district and Eagle Rock area of the Laramie Mountains, the Black Hills, and the Granite Mountains.

During the year, the WSGS discovered gem-quality olivine (peridot) associated with olivine lamproite in the Leucite Hills of the Green River Basin. The WSGS recovered more than 10,000 carats of olivine from two anthills in the volcanic field.

Gold exploration was reported at a few locations in the State. In the Rattlesnake Hills area in central Wyoming, company drilling identified a 7,780-kilogram resource with potential for 31,100 kilograms of gold. Mineralization in the district occurs in exhalites, breccias, stockworks, and Tertiary alkalic volcanics. The property is currently controlled by Stratmore Resources.

Several companies also conducted cursory exploration following the discovery by the WSGS of significant nickel, cobalt, gold, platinum, palladium, and copper mineralization in the Puzzler Hill ultramafic complex in the Sierra Madre. Exploration for titanium resources was reported in the Laramie Range anorthosite complex. The Strong Creek deposit, containing a 272 million ton low-grade titaniferous magnetite resource, is currently being explored.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1997 USGS mineral production data published in this chapter are estimates as of January 1998. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at http://minerals.er.usgs.gov/minerals/contacts/comdir.html. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved by way of MINES FaxBack or over the Internet at http://minerals.er.usgs.gov/minerals/.

[2]Ray E. Harris, Industrial Minerals and Uranium Geologist, and W. Dan Hausel, Senior Economic Geologist (Metals), both of the Wyoming State Geological Survey, coauthored the text of Wyoming mineral industry information.

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In 1997, the proposed abandonment of a rail line serving a bentonite processing plant in Casper threatened to deprive that plant of the primary transportation of its finished products to market. At yearend the situation remained unresolved. In the event of future rail line closure, the company (1 of 10 bentonite producers in Wyoming) planned to truck its products to its other plant across town where rail service was likely to continue. According to the WSGS, bentonite production overall continued to increase in the State, in part owing to a growing diversity of products made from and uses for the material.

In November 1997, Rissler-McMurry permitted a new limestone aggregate quarry about 3 kilometers west of Guernsey in Platte County. The limestone will be used for road construction projects in that area. The region's largest construction aggregate producer, Meridian Aggregates, continued production of crushed granite west of Cheyenne, in Laramie County.

In 1997, Mountain Cement permitted a new limestone quarry south of the existing quarry, assuring a continued supply of raw materials for its Laramie cement plant. Colorado Lien began production of limestone from the Hartville Quarry, 8 kilometers north of Guernsey, in Platte County. V.A. Resources of Casper acquired a permit to mine limestone at its Plumbago site, 48 kilometers northeast of Laramie. Basin Electric, which operates the coal-fired Laramie River Power Plant north of Wheatland and announced it was seeking a nearer source of limestone for use in the plant's emission control. The existing source is 64 kilometers from the plant, at the Bass Quarryinnorthwestern Goshen County.

Dimension stone production of cut and polished pieces of Wyoming Raven (black granite) and Fantastico (gneiss) continued at Sunrise Stone's quarry and fabricating plant. In 1997, an Italy-based stone producer acquired several sites to quarry dimension limestone and dimension granite in Wyoming. The company is proceeding with plans to construct a limestone fabricating (processing) plant in Laramie and a granite fabricating plant at another location in Wyoming.

V.A. Resources acquired the Plumbago Creek silica deposit in Albany County and the Cassa silica deposit in Platte County in 1996 and continued to permit both sites for future production. At yearend, a glass manufacturing company contacted the State and the WSGS regarding the utilization of one or more of these sites and the construction of a glass plant in the State.

Trona production in Wyoming is expected to have declined slightly in 1997 from 1996 and the record 1995 production levels. A major cause of this decline was the lack of railcars to ship refined products because of a railroad scheduling problem that took place in late 1997. Oriental Chemical Industry of the Republic of Korea began a major expansion project at its plant (OCI Chemicals) in the Green River Basin and is expected to increase its capacity by 33%. Tg Soda Ash, Inc. continued to develop plans to construct a new mine at its present site. The new mine will access trona bed 17. The current mine is developed in beds 24 and 25. Solvay Minerals continued with its major construction and expansion projects. The sinking of a new shaft at the Solvay Mine is on schedule. FMC Wyoming Corp. and General Chemical began operating with expanded capacity following the completion of expansion projects.

In 1997, U.S. Zeolite began mining clinoptilolite southeast of Bitter Creek in Sweetwater County. The zeolite is shipped to a facility in Utah for refining and shipping to markets. This is the first production of zeolite in Wyoming.

The First International Soda Ash Conference hosted by the USGS and the WSGS was held at Rock Springs in June. The proceedings of this conference will be published by the WSGS.

Uranium production in Wyoming is expected to increase over the 1996 level since a new operation achieved production in mid-1997. Rio Algom began in situ production of yellowcake at its Bill Smith site in the southern Powder River Basin northeast of Glenrock.

Uranium continues to be mined in Wyoming by in situ methods at Comin's operations at the Christiansen Ranch property in Johnson County. Cameco Corp. announced the purchase of Power Resources in situ operations at the Highland and Morton Ranch properties in Converse County, where production continued to increase. According to the WSGS, Wyoming was the leading producer of yellowcake in 1997 and was likely to continue to lead the Nation in 1998.

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Denver Post, 1997, Gem of a find, September 25, p. 1C.
Northern Miner, 1997, Redaurum to dispose of mining assets: Northern Miner, v. 83, no. 43, December 22-28, p. 6.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN WYOMING 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1995		1996		1997 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Bentonite	2,940	89,900	3,030	98,400	3,010	97,900
Common	30	W	30	W	30	W
Gemstones	NA	11	NA	11	NA	12
Sand and gravel, construction	3,860	17,500	3,420	14,700	3,220	14,100
Stone, crushed	4,670	27,500	5,180	30,000	4,900	29,000
Combined value of cement (portland), gypsum (crude), helium (Grade-A), lime, soda ash, and values indicated by symbol W	XX	838,000	XX	935,000	XX	855,000
Total	XX	973,000	XX	1,080,000	XX	996,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown

TABLE 2
CRUSHED STONE SOLD OR USED BY PRODUCERS IN WYOMING, BY KIND 1/

Kind	1995				1996			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone 2/	12	1,550	$6,430	$4.15	4	1,620	$5,330	$3.29
Marble	1	90	3,110	34.51	1	91	3,230	35.39
Granite	2 r/	W	W	5.80 r/	2	W	W	6.10
Quartzite	4	W	W	11.36	4	W	W	11.59
Volcanic cinder and scoria	1	W	W	11.25	1	W	W	9.00
Traprock	1	W	W	5.90	5	W	W	3.00
Other miscellaneous stone	1	11	67	6.09	--	--	--	--
Total	XX	4,670	27,500	5.88	XX	5,180	30,000	5.79

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits, except for unit value; may not add to totals shown.
2/ Includes "limestone-dolomite," reported with no distinction between the two.

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TABLE 3
WYOMING: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1996, BY USE 1/ 2/ 3/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch), other coarse aggregate 4/	17	$220	$12.94
Coarse aggregate, graded:			
Concrete aggregate, coarse	W	W	7.56
Bituminous surface-treatment aggregate	W	W	3.38
Railroad ballast	W	W	6.00
Fine aggregate (-3/8 inch):			
Stone sand, concrete	38	325	8.55
Stone sand, bituminous mix or seal	W	W	8.89
Coarse and fine aggregates:			
Graded road base or subbase	1,160	3,110	2.67
Terrazzo and exposed aggregate	73	1,570	21.45
Other coarse and fine aggregates	W	W	11.56
Other construction materials	536	4,860	9.07
Special:			
Mine dusting or acid water treatment	9	250	27.78
Whiting or whiting substitute	2	100	50.00
Other fillers or extenders	39	1,540	39.44
Other specified uses not listed	24	193	8.04
Unspecified: 5/			
Actual	3,220	17,500	5.45
Estimated	55	300	5.45
Total	5,180	30,000	5.79

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ To avoid disclosing company proprietary data, no district tables were produced for 1996.
2/ Includes granite, limestone, limestone-dolomite, marble, miscellaneous stone, quartzite, traprock, and volcanic cinder and scoria.
3/ Data are rounded to three significant digits, except for unit value; may not add to totals shown.
4/ Includes riprap and jetty stone.
5/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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TABLE 4
WYOMING: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products	855	$4,410	$5.16
Asphaltic concrete aggregates and other bituminous mixtures	455	2,450	5.39
Road base and coverings	1,030	3,800	3.68
Fill	191	478	2.50
Snow and ice control	34	310	9.12
Other miscellaneous uses 2/	15	45	3.00
Unspecified: 3/			
Actual	400	1,810	4.52
Estimated	444	1,350	3.04
Total or average	3,420	14,700	4.28

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filtration.
3/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

TABLE 5
WYOMING: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1996,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products	429	1,790	427	2,620
Aspalticbituminous mixtures	W	W	W	W
Road base and coverings	626	2,410	406	1,390
Fill	64	266	126	211
Snow and ice control	W	W	W	W
Other miscellaneous uses 2/	177	1,030	326	1,780
Unspecified: 3/				
Actual	400	1,810	--	--
Estimated	321	982	123	366
Total	2,020	8,290	1,410	6,360

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filtration.
3/ Includes production reported without a breakdown by end use and with estimates for nonrespondents.

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